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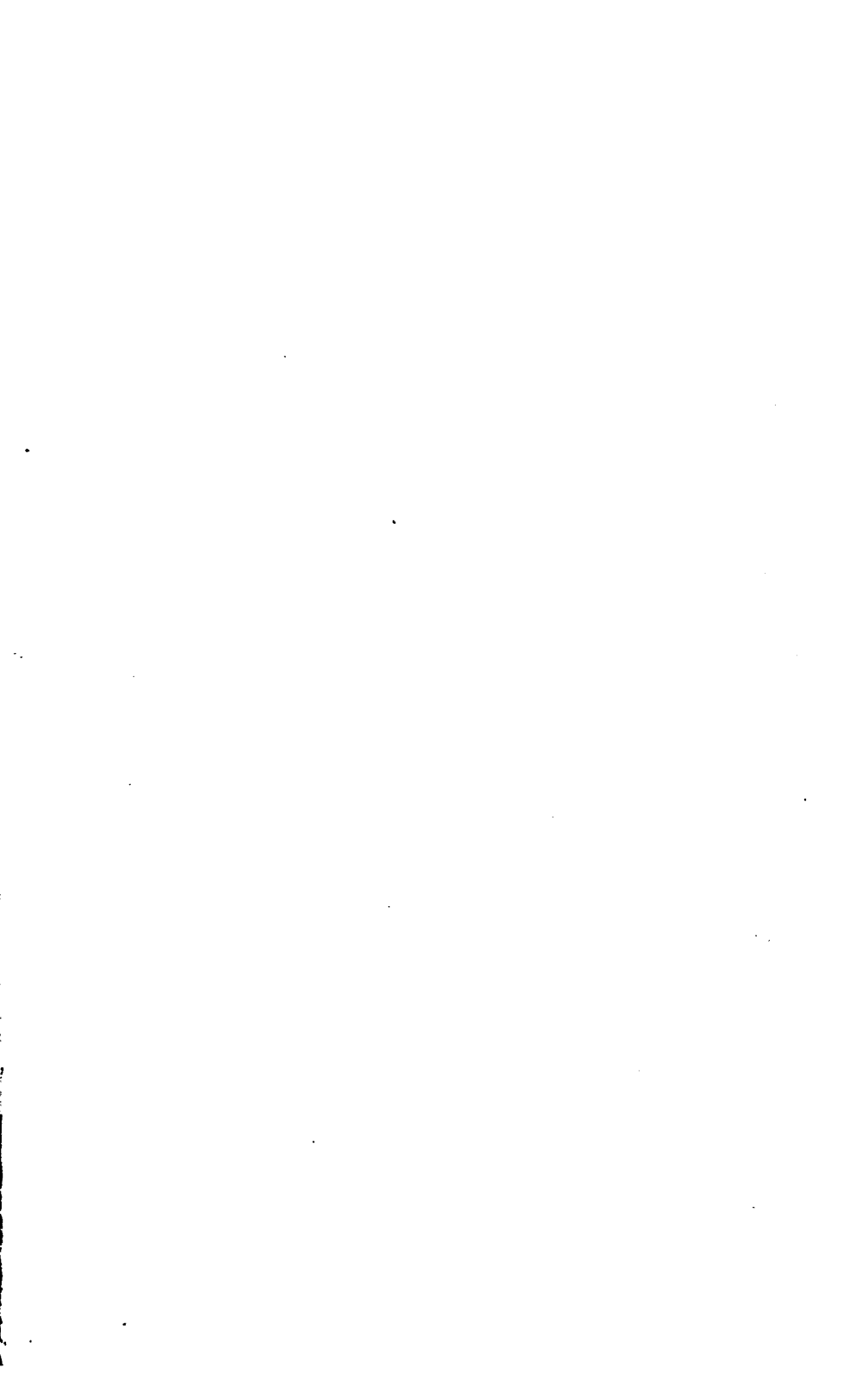
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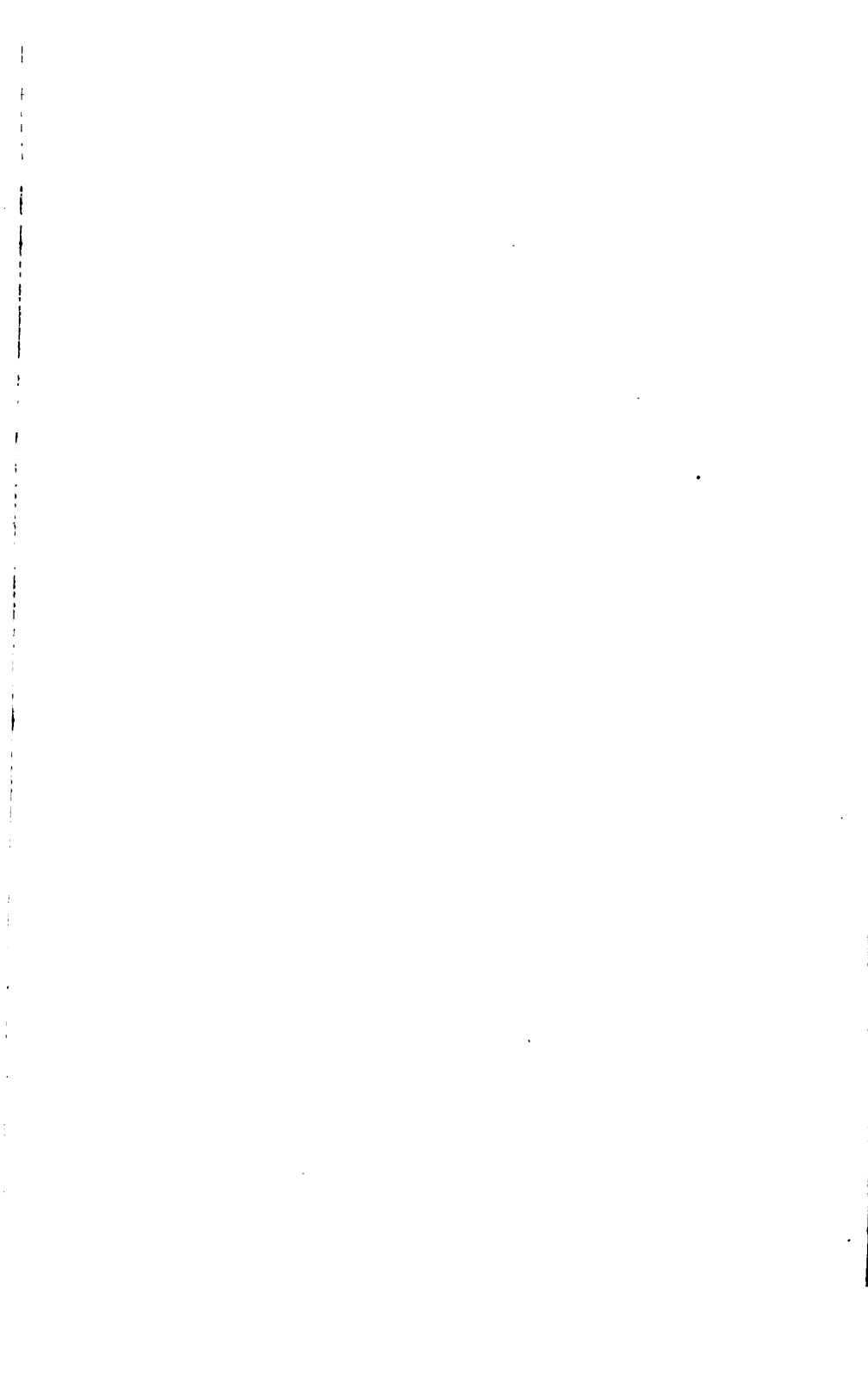
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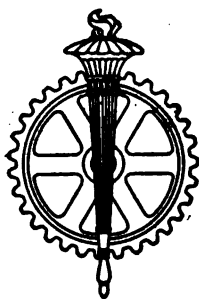
COST REPORTS

FOR

EXECUTIVES

AS A MEANS OF PLANT CONTROL

BY
BENJ. A. FRANKLIN



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INTRODUCTION

THE volume to which this announcement is an almost needless introductory reassembles a series of articles originally prepared by Mr. Franklin for appearance in *The Engineering Magazine*, and published in its issues from January to August, 1912.

In this treatment of a subject upon which much had already been written, the author approaches the study of costs from a distinctively new point of view. This is the point of view of the executive and not that of the cost clerk. It is the interpretation of cost totals, and the analysis of those totals into their significant components—not the recording of cost details, or the assembly of these details on prescribed forms. The purpose is to bring out the invaluable help which cost accounts may render to the manager—not to show how the daily routine may be accomplished by the cost department and its employees.

The presentation therefore lays little stress upon the headings and rulings of forms and cards or the details of clerical work. It lays much stress upon the substance of the information which the forms should present, and the interpretation of that substance so as to direct manufacturing and commercial effort always toward more profitable result.

The discussion is thus directed, first, toward the principles and elements which must be recognized to make cost reports afford a true and instant revelation of actual conditions. It proceeds, next, to the methods by which these principles may be applied and the elements obtained and assembled. Progressing thus from the greater to the less, it examines details of cost collecting only so far as they are important and interesting to the higher official.

Nevertheless, while the first purpose is to emphasize the value of correct cost methods to the manager, that very emphasis directs the vision of the auditor and the cost accountant to the significance which cost figures may be made to convey; and thus the work becomes of more value to the auditing and cost-accounting departments than many treatments of the subject which do not look beyond the desk of the clerk, and therefore fail to lift his vision to the paths leading upward from clerical routine to executive authority and industrial management.

CHARLES BUXTON GOING.

PREFACE

THE object of this book is to discuss with the executive of a manufacturing plant, after a considerable experience, not how to build a cost system, but what he should have when his cost system is built; to illustrate it by actual forms filled with figures to make their use clear; and to discuss with him the values, the uses, and the essential necessities of a right and practical cost system, with the idea in mind constantly of showing how, through casting it into the forms shown, the vital operations of his material, labor, and expense, and their relations one to the other are made plain, and the whole manufacturing situation so illustrated as to offer him a grip upon it.

The writer believes that cost is the basic, the fundamental factory improvement, through which the able executive can exercise control, which further suggests, urges, and brings about other improvements when it is intelligently operated. Intelligent operation involves understanding and practice of the philosophy of costs which is outlined in this volume.

No attempt is made to cover every ramification, but the main points are illustrated and covered, and an understanding of these will necessarily lead into all necessary details.

The forms are not intended to be applicable to any particular business, and must essentially be cast up in varying ways according to conditions. They illustrate merely the principles.

Too little attention, the writer believes, has been given by executives to a right understanding of the methods and possibilities of cost systems in manufacturing plants, yet it is believed that the study will highly reward any practical man, and it is hoped that this attempt at a practical treatment of the subject will meet with enough attention to hasten the inevitable time when cost-system knowledge will be an essential requisite of the able manager.

BENJ. A. FRANKLIN.

December, 1912.

CONTENTS

	PAGE
CHAPTER I. THE PHILOSOPHY OF COSTS	
Profit an Essential Aim of Manufacture—	
Knowledge of Profit Depends upon Correct Costs	
—Correct Cost Based on Mathematics—Value of	
Accurate Costs Often Overlooked—Value of Un-	
derstanding the Philosophy of Costs—Small Ex-	
pense of an Effective Cost System—The Main	
Divisions of Costs—Variation of Costs at Differ-	
ent Times—Reason for Cost Variation—The Ex-	
pense Element—Use of Imagination in Interpret-	
ing Costs—How It Enables the Executive to	
Visualize Conditions in His Plant—Standards as a	
Basis for Cost Interpretation—Standards when	
Determined Reveal All Departures from Normal	
—Value of Promptness in Obtaining Cost Figures	
—Seven Essential Cost Facts, and Periods at	
Which They Should Be Determined—Proper Use	
of the Cost System—Characteristics of the Ideal	
Cost System	15
CHAPTER II. THE PLACE OF THE TRIAL BALANCE IN THE	
COST SYSTEM	
Relation of the Trial Balance to Costs Usually	
Very Distant—Costs Should Be a Part of the	
Bookkeeping System—How the Connection May	
Be Established—Form 1, Trial Balance, Giving	
Monthly Showing of Manufacturing Costs and	
Conditions—Use of the Form Explained and Its	
Significance Discussed—Form 2, Sub-Statement,	
Affording Monthly Comparisons—Use of Form 2	
Explained—Possibility of Monthly Production of	
Trial Balance and Sub-Statement	41

CHAPTER III. THE COST OF THE SALABLE ARTICLE

Accurate Cost of the Salable Article One of the First Results Expected of a Cost System—This Cost Must Be Proven and Immediately Comparable with Other Costs—Many Business Failures Result from Unproven Cost Figures—Many Cost Systems Faulty because Undertaken from the Wrong Point of View—How Accurate Costs Should be Found—Form 3, Executive's Order Cost Record—Its Items Explained—Form 4, Details of Order Cost—Form 5, Costs of a Single Part—Relations between Forms 3, 4, and 5 Pointed Out—Form 6, Cost Details in Manufacture of Small Staple Goods—How These Forms May Be Made to Visualize Plant Conditions—Proper Periodicity in Presenting Order Costs—Values to Be Obtained from Order Costs—Possible Extension of the Use of Order Costs . . . 53

CHAPTER IV. THE ECONOMIC CONSIDERATION OF MATERIAL BY COSTS

Definition of Material—Two Classes of Material—Difficulties in Getting Accurate Records of Direct Material—The Application of Material in Article Costs—Wastes of Material—Their Enormous Extent—Four Principal Forms of Material Waste—Form 7, Which Detects Waste in Progress of Manufacture—Form 8, Showing Waste in Mass Production—Form 9, Showing Waste of Spoiled Work—The Importance of the Study of Waste—The Purchasing Department and Its Relations to Waste—Form 10, Material Journal—How It Connects Material Reports with Bookkeeping Accounts—The Use of the Form Discussed—Absolute Accuracy of Material Costs Obtainable—The Economies to Which the Cost Consideration of Material Leads . . . 67

CHAPTER V. LABOR FROM THE COST VIEWPOINT

Labor the Central Element in the Cost Trio—Its Chief Interest to the Executive—Its Two Di-

CONTENTS

11

PAGE

visions from the Cost Viewpoint—Difficulties in Apportioning Direct Labor to the Cost of Production—The Best Method of Getting Labor Costs—Form 11, an Improved Payroll Method—Its Advantages to the Cost Clerk and Bookkeeper—Form 12, Details of Operation Times and Costs—Values Obtainable from the Use of Form 12—Comparisons Necessary to Its Usefulness—The Moral Effect of Labor-Cost Records—Why Labor Records Should Come under the Eyes of the Executive .

87

CHAPTER VI. THE VEXING QUESTION OF EXPENSE

Two Main Points in Considering Expense as a Cost Item—The Many Theories of Expense Distribution—No Theoretically Accurate Method Exists—How to Reach a Practical Theory of Cost Distribution—The Two Elements to Be Taken into Consideration—Various Methods by Which Expense Varies—Applying Expense by Two Measures of Variation—A Working Solution—Expense as a Factory Disease—The Executive's Purpose Is to Keep the Factory Healthy—Expenses May Be Displayed So as to Control the Running Situation—The Expense Problems of Irregular Volume of Production—Treatment of Unprofitable Lines of Production—Recapitulation of the Elements of Practical Expense-Distribution—Arrangement of Expense According to Like Groups—Form 13, Department Apportionment of Depreciation, Taxes, and Insurance—Form 14, Details and Totals of Power Cost—Form 15, Details and Apportionment of Repair Cost—Form 16, General Expense—Form 17, Department Expense—Form 18, Selling Expense—Form 19, Expense Analysis—Coöperation in Studying Expense Analysis and Securing Improvement . . .

99

CHAPTER VII. STATISTICS AS AN AID

Expense Figures alone an Insufficient Guide to the Executive—The Cost System Must Be Butressed with Statistics—Statistics Should Be Sup-

plied by the Cost Department—Common-Sense the Best Guide in Their Preparation—Statistics of the Selling Situation First in Importance— What Statistics Should Be Shown—Form 21, Volume of Sales—Form 22, Comparisons of Sales by Periods—Form 23, Distribution of Sales by Locality—Form 24, Analysis of Sales by Custom- ers—Form 25, Salesmen's Results—Statistics of Advertising Results—Uses of Statistics as a Guide to Production—Statistical Showing Should Be Il- lustrated—Graphic Methods of Showing Statis- tics—Form 26, Weekly Cost and History—How It Shows the Entire Progress of the Depart- ment—Duty of the Executive to Study and Inter- pret Statistics	123
---	-----

CHAPTER VIII. COST-SYSTEM—THE BASIC IMPROVEMENT

Universal and Valuable Employment of Cost Figures in the Future Assured—Analyzed Costs Will Be Essential to Scientific Adjustment of Tariff—Cost Figures Indispensable to any Gov- ernment Regulation—Possibilities of a Govern- ment Bureau of Costs—Value of a Right and Practical Cost System in an Individual Plant— What a Right and Practical Cost System Should Be—Relations of the Cost System to Accounting —Practical and Correct Knowledge of Costs Es- sential to Success in Competition—The Executive Must Understand His Costs—Executive Indiffer- ence Responsible for the Weakness of Cost-system Practice—The Best Way to Build a Cost System —Persistence and Time Are Essential—A Proper Cost System Promotes Good Organization, Pro- vides a Barometer and Thermometer of Trade, and Insures against Unprofitable Undertakings— Standards by Which the Executive Must Test His Cost System—The Returns Which a Correct Cost System Will Bring Him	135
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THE PHILOSOPHY OF COSTS

CHAPTER I

THE PHILOSOPHY OF COSTS

AN essential aim and vital incentive of all manufacture is profit. Profit is the difference between the selling price and the cost of the manufactured and sold article. The selling price is a quantity prearranged and known, logically based on cost. Therefore it must be the intelligent and necessary part of all manufacture to know thoroughly and accurately its costs.

Couple this simple and logical statement with the fact that the means to the end, the basic element in the structure of costs, is mathematics (an exact science and in its common and necessary terms universally attained), and it must surely seem but a natural conclusion that the philosophy of costs may be very plainly stated and readily understood, and that its practice, in all intelligent business communities, must be universal and complete. And not only is the logic of the situation plain in its demand for right costs, but wherever the practice is perfected this logic is always fully sustained.

Notwithstanding this, however, it is a matter of fact that the principles of application of the elements of cost are as yet in some dispute, and very little understood by those whose interests demand a proper understanding; costs as practiced in the larger percentage of plants bear no happy relation in exactness to their base, mathematics; and one need not possess many of the physical characteristics of a centipede to be able to count on the fingers and toes those concerns which have developed costs to their highest value of practical accuracy and usefulness.

Executives stick to the old rule-of-thumb methods; sell at given prices because their competitors do; or cut these prices with the idea of corraling orders, without any certain knowledge of costs, depending on their business instinct to span successfully the gap between certain figures and experience they possess, certain factors they assume, and the actual proven facts of the case. Time and the shrewdness of the stronger and more courageous in upholding prices, have come to the relief of many with this lack of costs, but many of them have needlessly succumbed and gone to swell the list of business tragedies recorded by Bradstreet and Dun.

Now, an important reason for this is that, despite the importance of the subject (seldom properly realized in any plant), the philosophy of costs is not well understood of many, being not as simple

as might first appear, and, as a measure of practice, is not often used; and so this effective inspiration to proper development of a cost system is lost. Add to this the more apparent and present reason that in a plant of any size or complication of product not only is the daily detail of figures to be assembled and sorted to their proper places very large, but what is more difficult to cope with, the accurate collection of them involves the tactful, patient training of a good deal of perverse and unintelligent human nature, and frequently somewhat costly re-arrangement and handling of material. To these difficulties the executive (in a spirit of economy) makes the further addition of entrusting the task to inefficient or insufficient help.

Nevertheless, the day of cost rule is dawning. Everywhere cost systems are being installed, and there are few executives today who do not possess at least the desire for a complete cost system. But the lack of ability (through unfamiliarity) on the part of most of them to recognize when a cost system is right, complete and serviceable, and the fear of red tape and the expense of maintaining it, deter too many from obtaining the goal of their desires, and cause very many unfinished systems to limp along rendering what services they may.

Yet a thoroughly effective and proved cost system may be maintained, when properly introduced, at a very low clerical cost, and the values obtain-

able from it are always incalculably greater than this cost.

The philosophy of costs is of much wider interest than the mere logic of its fundamentals. The main divisions of costs are simply stated and well known—materials, direct labor, and expense.

To anyone vitally concerned, accuracy should appeal as a first requisite of costs. It would be more appropriate, however, and truer to the facts of the case, to speak rather of practical than of absolute accuracy in considering this quality.

The cubical contents of an iron tank can be calculated with absolute accuracy, but the cost to manufacture the tank cannot be found with the same provable accuracy. The contents of duplicate tanks will remain constant. The cost of duplicate tanks may, however, from time to time vary markedly.

This variation of the cost of the same article at different times constitutes the important point, not only in the proper understanding, but in the appreciation of costs. The ability to master this point and to figure estimates or predictions of cost from a standard under varying conditions gauges the comprehension or the meaning and value of practical costs.

Now the reasons for these cost variations are apparent upon consideration of the main divisions of cost structure. The laws governing the application

of cost in the matter of material and direct labor are sufficiently plain and direct, viz.—to record the actual expenditures for these two items as applied to the particular article in question, since such expenditures can invariably be traced in their direct application. But the laws, or rather indeed the rules, governing the application of expense to the cost of a particular article are not clear nor easy to define. Very seldom can expense items be unquestionably charged to a particular article cost. Many expenditures can be shown in logical relation to divisions, classes of work, machines, or departments of manufacture, and certain others are distinctly general to the whole manufacturing proposition, or divisible over sections of the whole in varying percentages.

The necessity therefore arises in manufacture to make the most logical and practical distribution of expense to article costs that will suit the case, and the logic of this situation is so arguable that experts frequently produce different results from the same conditions. The crux of cost comprehension is in expense consideration.

But there remains one absolute certainty in the situation, viz., all the expense is in some way divisible over the total product, and it is a happy feature of the element of expense, that, once the proper rules of distribution have been decided upon, it becomes much simpler to obtain and distribute

in costs than the elements of material and direct labor.

So it happens, then, that there is in every factory a large general expense divisible over the whole product, which, between certain fairly wide limits, does not vary with the product. It is therefore plain that as the production varies (and it certainly varies in all factories) the share of expense applicable to any one article also varies, and thus the cost varies even when the material and labor unit cost, by prearranged means, may remain stationary. As the production goes up the expense unit cost goes down, and *vice versa*.

It is of course this well-known fact of cost variation, that increased production reduces cost, which is at the base of the great struggle of the American manufacturer for volume—a struggle frequently made with a trust simply in the general principle without concise and reasoned plan; here also is of course one of the basic arguments for trust existence.

The method of application of expense, that is, dividing it over all production, compels for practical purposes the taking of percentages of expense for cost use, not in the exact amount of its occurrence during the period of manufacture of a given article, but over a reasonably long period, and in an amount which, on account of constant fluctuations of expense, may be either greater or less than

the percentage that would be obtained for just the period of manufacture of the article in question; so that while material and direct labor costs may be absolute in accuracy, the expense can never be, but in relation to any one article must be approximate, being absolute only when all costs are added together.

These two points then—the inapplicability of expense directly and in exact period to the unit article in the same way as material and direct labor, and the consequent necessity of the division of a fairly fixed expense by a frequently varying product—make the accuracy of cost practical rather than absolute.

But this statement of the case of accuracy should not be misunderstood. It is unfortunately the fact that to this constitutional difficulty of costs many manufacturers, who have essayed the cost problem in their plants, have added the further and needless one of carelessness and incompetence.

While the accuracy of unit order or article cost may not be absolute, the cost of total product can and should be proved absolute. This can be done only by connecting it with the accounting or book-keeping methods of the plant wherein should be entered such valuable safeguards as depreciation, etc., so that the trial balance of the books shall prove the whole proposition of accuracy. In all cases where work is done on order numbers, the

cost system can most economically be an integral part of the book-keeping, as will be seen later. In cases where it seems inadvisable to handle the work thus the proof with the books is just as sure. Any plant without such connection has clearly not understood the cost problem.

There is one element essential in the true philosophy of costs, the presence of which makes it vivid and interesting, and the lack of which makes the practice either very hard drudgery, or slack and inaccurate, and the interpretation barren,—and this element is imagination. Certainly the use of costs, the sole reason of their existence, has been much retarded by this absence.

It may not indeed be too much to say that this lack has retarded the proper development of costs, and is not a little responsible for the failure of the practical man to interest himself vitally in this essential of his business. He has left it, for development, solely to accountants, able as they may be, and for operation, to strictly office trained men, generally of small pay; both without that training in factory life and viewpoint which develops the practical instinct necessary to guide, through the cold cost figures, that imagination which will make of a cost system a panorama of the movements and groupings of shop events.

It is not to be understood that imagination here used is intended to mean the luring up of non-ex-

istent conditions, but it has really two very valuable uses in practical results.

The executive sitting in his office examining the costs should be able, as the figures run before his eyes, to visualize the shop conditions to which they have reference—the machines, the men, the materials, the connecting operations. Then, as the figures vary from the standard, imagination lends them a meaning that urges results. For as they vary from this standard the practical mind detects the weaknesses which ability, authority and direction can correct to profit, or discovers evidences of a strength worthy of effort for duplication. Imagination makes cost figures a universal language of manufacturing.

Thus may be detected wastes of material, lost time of labor, careless expenditures, weakness of machinery, losses of profit, items for investigation.

And a further use for imagination, especially in plants where efficiency has not been highly developed in a scientific manner—and their name is legion—is that it will very frequently urge the possibility of higher standards by occasional units discovered in the cost system.

These losses and opportunities in very many plants would and do, without a cost system, in all probability take their own long time in coming to corrective attention.

As a matter of fact, costs with imagination (and

indeed without) offer the modern plant one of the first steps and the most urgent spur towards methods of higher efficiency.

And how well, with imagination as a guide, can a right cost system play for the executive, returned from an absence from his plant, the drama of shop life, the moving-picture show of its practice, the course of production, wastes, labor, making clear the tragedy of losses and the comedy of successes! In fact, the business man can safely leave his plant under such conditions, satisfied that upon his return he can know with some surety that it has operated as well as usual, or where it has failed to do so. While figures form the body of costs, imagination gives them a soul.

Now, for the right and best exercise of this imagination in costs there is necessary another element—practical instinct. To get the best value from a cost system without the practical instinct is something like trying to master a foreign language with the sole aid of a dictionary and a grammar. The practical instinct is not essentially confined to the practical factory man. Indeed he does not always possess it. But it requires a practical mind which at least readily learns shop conditions by observation, analysis, and by shrewdly questioning the practical men.

This practical instinct, urged by the desire to make improvement and aided by imagination,

reads the message of costs and by inspiration, inquiry, suggestion and scientific investigation finds methods of improvement. When costs have brought about this they have accomplished one of their highest and most practical values. Practical instinct not only makes of use the figures presented, but likewise performs a very valuable function in preventing (what happens in very many plants) the compiling of masses of figures which have no practical or complete value.

Another element essential in cost consideration should not be overlooked too long—viz., standards. Efficiency is attained only by a striving for high standards. These standards may vary in their origin in different plants. They may far best be scientifically worked out; they may be fixed at a desirable percentage below the selling price; they may be the best previous record; they may be the mark set by a competitor, as the conditions of advancement of the plant along the line of struggle for best methods may dictate; but of course, for best results, they should be the highest standards. The jumper strives for a mark beyond his best reach. Human nature demands a goal, but the standard should not be unattainable.

We are led naturally from standards to comparisons as an essential element in the philosophy of costs. Costs are not stable. With the best effort they vary constantly and sometimes markedly, while

selling prices vary slowly when at all. Comparison with standards and with other costs as representatives of conditions, brings effectively to the practical mind those points valuable for investigation and action.

As far as possible the practical mind should be used in consideration of as few figures as possible, and these the vital ones. We are thus led to another very important and frequently fatally overlooked point—arrangement.

It is a psychological fact that the human mind, and especially the practical executive mind accustomed to deal rapidly with conditions as they arise, becomes fatigued with long consideration of figures and the attempt to extract important facts from them. This, therefore, makes it important that through arrangement there should be brought quickly to the attention the important indicative figures, and the detail, likewise carefully arranged, may then be gone into only as the variation of the important indices from the standards, or the normal inquisitiveness of the executive demands. Thus the discerning mind can with vigor and freshness cover the entire field, and at the same time quickly get to the bottom of any situation. It may be valuable to suggest here also that cost figures should be in such detail that, with practical knowledge of the situation, there shall be no necessity to delay investigation while further analysis is carried

on. The figures of detail should picture the facts simply. As a matter of practical fact the cost system is most effective where the cost clerk is of such calibre as to be able to select, investigate, and report upon those instances where the variations of costs indicate weakness or possibilities of betterment.

An important element essential to valuable costs, and one often overlooked, is periodicity, or promptness of results after occurrence. The promptness or speed with which a cost—the picture of an event or concourse of events—shall be produced, depends of course on the nature of the event, the space of time it covers, and its relation in economic value to succeeding events. Too little is it understood and practiced that all expenditures should best be studied *before made*, as to their value and relation to the whole; and it is quite possible in a well arranged shop where a good cost system prevails to predict fairly accurately many costs. But of *costs after the fact*, which will always be the great value in any cost system, it is of course as ridiculous to call to the attention daily the day's share of taxes, as it is to bring forward the costs of a certain minor operation a month after its occurrence. The necessities of the case will vary in different plants, but in most the facts are practically to be considered thus: (1) wastes, daily and in relation to the order or run; (2) operation costs, daily in relation to the

article and machine; (8) order costs, the day after the order is finished, or once a week; (4) production, varying with the kind of product by the day, run, or week; (5) the payroll, consideration by the week; (6) special expenses by the job, and (7) general expenses by the month. Familiarity, practice, and control of the situation modify these times of presentation, but that system which can not approximate a desired schedule is weak, and values are being wasted.

When a cost system is finally in operation there is one essential to its greatest effectiveness which is much too seldom considered—viz., co-operation of the executive organization in its study and use.

In a plant of any size it is impossible for one man, the executive, to keep under his control all decision and action. He must necessarily delegate it in varying degrees along down the line of his organization. Gradually, as the press of his duties demands and confidence in his subordinates permits, he leaves more and more to these subordinates. Now it is only the merest common sense to consider that if a cost showing of the facts is valuable and necessary to the executive in his decisions and actions, it is all the more so to his subordinates, since while their sphere of action is smaller, likewise it is generally a fact that their ability to cope with the situation is smaller. Moreover, if the cost system is an enlightenment to the executive, why should

his subordinates be compelled to work in the dark? But even from a broader point of view it is a certainty that in any organization greater results are to be obtained by co-operation of many minds intimate with a subject (and subordinates are generally more intimate with the details than the executive), than from one mind.

Many executives will object that they do not desire their subordinates to be familiar with the figures of their business; but if a previous essential—right arrangement of the cost system—is had, no subordinate need see any portion except that which concerns his work especially, or such other figures as the executive pleases to show him, and in no case need he see the final results in the trial balance. The cost system has not obtained its highest value until it has met the co-operation of the organization in its study and use.

Many of those who have spent considerable sums in maintaining a cost system, have overlooked, in considering its final economic value, what proves to be its main virtue after the passing of that period of a year or more during which the initial knowledge presented of costs of articles in relation to their selling prices has brought about desired readjustments. This virtue lies in the use of the cost system as a means of control of factory departments and divisions, and as a basis, not merely of reduction of cost of a particular article, but of ac-

tions tending to reduce in cost the whole line of manufacture, or to changes in any direction looking towards betterment.

This latter conception of the value of costs is the broader and more intelligent, and properly involves the keeping of all statistics under the head of the cost system. As a means of gauging and controlling operations, divisions, departments, wastes, production, and relation of controllable and uncontrollable conditions to the whole situation—of discovering, in fact, the real status of the plant as a basis and gauge for working it intelligently toward betterment (for which purpose the trial balance is in a large percentage of cases a very crude instrument) the right cost system has large opportunities of development before it. The value of costs in relation to a particular article is in no sense to be belittled as a basis for economic action, in addition to its value as a selling basis; but it is very plain, that, while an economy inspired by such cost figures may lead to a further economy throughout a whole varied product, there are many details in it that are only subdivisions of some expense general to many or all articles, and such divisions do not lend themselves to criticism. But an action based on a showing of the situation as a whole will generally lead to a reduction all along the line. And it is true that many expenditures are not properly valued until their relation to the whole situation is

shown and balanced against the advantages rendered. Only this broader view and use of costs offers a brief for proper judgment. As the development of the idea of standards progresses, this broader view will offer a means of gauging the whole with a standard; for just as there should be standards for the smaller units, so there should be standards for the larger, for groups of units, and for the whole.

This broader use of cost system as a means of control of the business, comes most effectively, however, only with a thorough understanding of cost system, in its proper arrangement and use with imagination and practical instinct, and of the philosophy of costs, but it gives a wider and more comprehensive view of factory life than personal supervision and the trial balance can, since the one discovers only local and momentary action, and the other shows the final result too much condensed and too composite.

Such a use does not demand a different or separate arrangement from that necessary in obtaining article or order costs, but, in fact, the proper arrangement for it makes more simple the obtaining of such costs. And with such proper arrangement in a well organized or controlled factory it carries the setting for a quick assembling of predicted costs or estimates.

To be able to predict costs accurately in advance

is a longer step forward in factory management than may at first be thought, for it indicates a high state of development of proper methods. But it is very easy to do, confidently, when two conditions exist in the factory—good methods of control of labor and material, and a good cost system.

A point of much commercial importance, and one in which again the apparent logic of the situation does not furnish a complete answer, is afforded in the fact that, though the cost of an article may prove to be higher than the selling price and thus show a unit loss, it does not necessarily increase the total profit of operation to cease the manufacture and sale of articles thus showing a loss. The reason is plain enough on a consideration again of the fact that general expense has no direct application in the cost of any particular article, but that the expense portion of individual cost is only obtained by dividing total expense over total production. It follows then that when any line of production is cut out, the share of general expense its cost has absorbed must simply fall additionally on the remaining product. It is therefore a matter of simple mathematical proof that, even when costs show losses on individual articles, the change of the total profit upon the elimination of any article varies with the relation of this loss to the expense apportioned to this article. When the loss is greater than the apportioned general expense, ces-

sation of manufacture increases the total profit. When the loss is less than the expense burden, cessation of manufacture decreases the total profit. Here then is a law, the application of which is frequently needed in plants developing cost systems, for such plants discover that, through ignorance, they have been selling some articles under cost, and the solution is one requiring careful review of the selling and manufacturing situations, and the use of common sense. Theoretically it is right that all articles should be sold at a fair profit, but competition inclines to make this a fair profit on the cost of the most efficient manufacture, and ignorance of cost has frequently aided competition to make the manufacture of some articles unprofitable to all. And outside of this consideration of profit there enter many other reasons that seem to compel some concerns to sell articles at an individual loss, such as the necessity of completing a line with a losing article as a leader, paralleling a competitor to sell the profitable part of a line, keeping up production in an expensive organization or equipment, or in dull times.

In the consideration of higher cost of living the element of increasing knowledge of costs has never been given much weight. Yet it is not impossible that it has had its effect. Many associations of manufacturers have realized in the last ten years the ruinous effect of ignorant competition and met

it by adopting uniform cost systems. In their work it has proven to be more important that all manufacturers in one line should handle like items of expense alike than that they should handle them according to any definite rule. It is proving for these associations an eminently wise action, although they have hardly begun to reap the benefits because of two unfortunate difficulties in the consideration of cost system. These difficulties come about through a lack of understanding and appreciation of the true philosophy of costs and certain psychological traits that show themselves invariably with executives in the matter of costs. The first difficulty is the fatal hesitation and delay which most executives display in having a complete cost system installed in their plants. They have generally worked out some rough figures of cost, and their familiarity with the situation and the articles, and their ignorance of the possibilities to be obtained from a discriminating and proved cost system, lead them to believe that with these incomplete figures their understanding, guided by their common sense and business instinct, gives them all the control there is to be had of the matter. Indeed there seems to be some fatal insidiousness about costs, aided by the fear of detail, whereby the executive easily satisfies himself when he has gone part way in development of a cost system. He does not sufficiently consider that while it may

be true that figures do not lie, when they represent costs they must be cross-examined quite severely to get the whole truth out of them.

Nothing but the actual possession of a right cost system, proving its value, ever changes this view of the executive entirely; but this always changes it.

The second difficulty is that in most plants, when the executive has consented to install a proper system, it takes so much longer to get into active operation, and there appear so many more delaying difficulties of human nature or rearrangement than he is accustomed to in putting through the usual improvements, that he frequently stops somewhere short of the desired and necessary result. In the ordinary shop at least a year of hard work and hearty co-operation is necessary to bring about a thoroughly right cost system.

The future of costs is sure, because the logic of them, as displayed in the first paragraph, is now indisputable, and as time goes on will make them indispensable.

Common sense urges their value, for certainly the executive who depends on his judgment, ability and experience and that of his organization, loses none of that value when he possesses in addition a cost system; but he gains an added help and guide, and furnishes his organization that which human nature, for spurred effort, finds indispensable—a merciless gauge as to the real results of their com-

bined efforts. And as the science of management advances, cost system will be more necessary to assure and sustain the high level. But promised results will not be accomplished without a right cost system. What then is a right cost system?

A right cost system is a proved cost system, so designed that whether operated through the book-keeping system, or with the book-keeping system, the figures presented in total, in sections, in divisions, in departments, in order costs, in article cost or in operation cost, the facts as pictured by the figures, are proven with the balanced book-keeping system to include all items of material, labor, expense, plus such items of conservation, in depreciation, etc., as may be decided upon. Add to this an understanding of the philosophy of costs in interpreting the figures, and the highest ideal of cost value is attained.

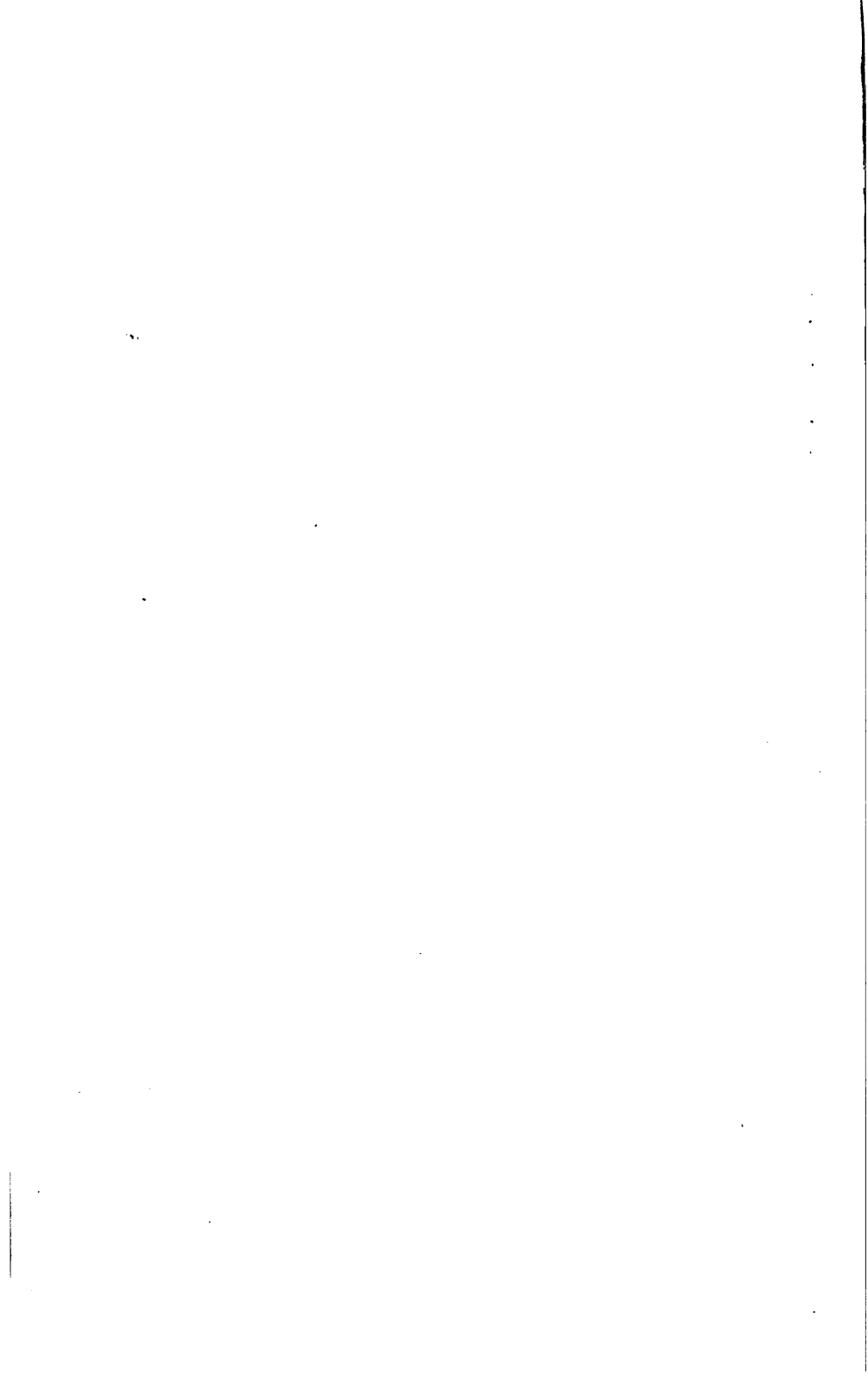
To recapitulate, then, the ideal cost system is one,—

Proven with the books,
Operated in practical accuracy,
Visualized with imagination,
Interpreted with the practical instinct,
Braced with standards,
Vivified by comparisons,
Made simple by arrangement,
Made effective by prompt periodicity,

Made active by co-operation of organization in study and use,

and one that not only gives article or order costs and the necessary details thereof, but gives division or department costs, and the vital details of these for control of the parts and the whole. Operated thus a cost system becomes not merely a valuable practical asset, but it becomes an enjoyment in the game of business.

**THE PLACE OF THE TRIAL BALANCE
IN THE COST SYSTEM**



CHAPTER II

THE PLACE OF THE TRIAL BALANCE IN THE COST SYSTEM

IN the ordinary practice of the cost systems of today the relation of the trial balance to the costs is very distant, and not infrequently the connection is untraceable absolutely. The trial balance is considered as a monthly means of proving the accuracy of the book-keeping but, as a means of indicating to the executive any facts about the operation of the plant, it becomes interesting only after stock-taking periods.

Yet, as a matter of fact, while the general practice has not borne it out, the book-keeping system, of which the trial balance is only the periodical statement of balances, is the right and natural cost system. It has not assumed its position as such merely because it has followed the lines of least resistance. It was always intended to tell the story of the business in a complete manner; but, in the grand majority of cases, the system developed to include only those items that came naturally and necessarily to the book-keeper in the form of bills paid or to be paid, and bills collected or to be collected—because all other items, analyses of these bills, indicating internal events, proved too difficult

to collect accurately, when at all. Not that this development is to be condemned, because this much has proven very valuable and essential, and the difficulties of obtaining through the book-keeping system a complete series of costs, and thus a trial balance giving a complete monthly showing of the business, are such as are not easy to be overcome.

Yet there are two vital reasons why the costs should be a part of the book-keeping system, and why the latter should universally assume the dignity and value of the recital of a complete story, and not be compelled to have the cost system as its sequel.

In the first place, the book-keeping system offers absolutely the only means of proof of a cost system.

In the second place, the trial balance offers the only possible complete representation of the condition of the business.

Connect the cost system properly with the book-keeping system, and the trial balance tells the whole story monthly. If the trial balance is the only possible proved monthly showing of the facts of the business, it is only common sense to cause it to show these facts in the plainest and most complete manner. It is therefore right and natural that, in any plant where a complete cost system is attempted, it should be put through the book-keeping system, since the trial balance will then prove

the situation, and show in the totals for the whole plant, what the cost system shows in detail for orders or articles.

Such a trial balance in the ordinary plant would be much like Form 1. The description of it may not be fascinating, but any executive who possesses such a monthly showing of his plant will certainly find the real thing decidedly so. In this illustration, it makes no difference, of course, whether the figures represent an actual case, or whether, indeed, they represent the kind of financing or managing that would be done by a captain of industry or his more modern place-taker, the scientific manager. They are merely representative of the method.

Observe then Form 1. No explanation will be necessary for the divisions:—Quick Assets, Quick Liabilities, Permanent Assets, Permanent Liabilities, Income on Investments, and Interest and Discount. They are common to all trial balances.

The "Manufacturing Accounts" are the interesting ones to the alert executive. The account, "Raw Materials on Hand" means just what it says, viz., the value in dollars and cents of raw material that should be on hand at the end of each month, if an actual inventory were taken. The terms "Class 1, 2, 3, 4, 5," are used simply in place of significant names of materials varying in kind and variety in different plants.

The account "Cost of Work in Process" likewise states its own case, and shows the value in dollars and cents tied up in unfinished orders in the different classes of work at the end of the month.

Under the head of "Profit and Loss Account" there appears the actual accumulated profit or loss on the sales of the several classes. Under this account there appears also "Unused Supplies"—meaning the value of expense supplies on hand at the end of the month, and the account "General Expense Undivided" covers such items as are not distributed in the costs each month, as the unused taxes, insurance, etc., which items, though paid generally once a year, should be distributed to costs only in equal monthly amounts, while the balance, being prepaid, remains as an asset until used.

Perhaps it might be well to indicate briefly how this trial balance is made possible. It will be remembered that it is the culmination of the cost system. The cost system, if it exist at all, must show the material, labor, and expense chargeable to each article or order made. Granted this, then (for such a trial balance cannot be drawn out of the thin air) the process, to be shown later in more detail, is very simple. The raw material when bought is charged to the "Raw Material" account. The raw material values used, collected through the cost system, are credited monthly to the "Raw Material" account, thus leaving only the value of un-

[illegible]

Attention is called to the fact that this trial balance tells the whole story of the business each month. First come the showings of the quick assets against quick liabilities, followed by permanent assets against permanent liabilities. Then, as explained in the text, the actual condition of the manufacturing situation is laid bare by a showing each month of actual values of raw materials on hand, money left tied up in work in process, and the profit or loss to date from a given starting date, all divided into such classes as the executive may choose. Only the bare necessities of the case are shown here. Further detail may be shown as desired.

NOTE. This sub-statement of the trial balance offers further detail and percentages of profit or loss on classes of manufacture A, B, C, D, the amounts of which are shown under Profit and Loss at the foot of the Trial Balance, Form 1. All the facts shown are obtainable from the ledger accounts, of which the amounts under heads Profit and Loss on the Trial Balance are the balances, and this sub-statement is merely a quick and clear analysis to point out to the Executive the strong and weak spots as to volume and value of his different line of manufacture, indicating the directions his efforts may best take.

used material, and are charged to the cost of work in process. To this account, "Cost of Work in Process," is likewise charged all the direct labor paid for monthly, since it is all used, and also all expense, except such items of the latter as remain legitimately in "General Expense Undivided," and "Unused Supplies." Thus each month all money spent on production is charged to "Cost of Work in Process." As shipments are made their costs are credited to the "Cost of Work in Process," and charged, under "Profit and Loss" account, to the class into which they fall, the sale prices being credited at the same time, thus making the balance show the net profit or loss.

Now the accounts under "Profit and Loss," by classes, are not sufficiently significant in themselves on the trial balance sheet, since they do not indicate the size of the sales on which they are the profit or loss. To remedy this a sub-statement is drawn from the ledger accounts very readily, and shows as per Form 2. Thus may be seen the sale, the profit or loss, and the percentage of profit or loss, for the month and for the period to date, on each class and on all classes.

It will be noted that the periods of trial balance indicated are the usual monthly periods. This is called to attention because there is some movement to have strictly four-week periods of trial balance. Of course, there can be no violent objection to this

if it offers advantages sufficient. The disadvantages of this method are that it causes thirteen instead of twelve trial-balance labors, and it is against the custom of the calendar and the practice of the day. This latter is not necessarily an essential objection if the advantages offered are sufficient. The main advantage of the four-week trial balance is that it offers equal periods for comparison at all times. But as a matter of fact it would seem that with a first-class cost system in operation, this is not a very valuable advantage, since in the matter of expense weekly comparisons offer a much better grip and comparison, and in other matters the vital points of comparison appear in other data, as weekly payroll, order costs, etc. It would therefore seem that since Cæsar inaugurated the calendar, and custom and use has fixed it as a universal basis of time, until some greater use than is yet stated for four-weekly trial balances is shown, or until the calendar is changed, the majority will make no mistake in this matter in rendering unto Cæsar the things that are Cæsar's.

Behold, then, the executive has on his desk once a month a complete and condensed showing of his business. Every month is inventory time with him, as far as results go. Can he use such a showing for the betterment of results? It may indeed be said here that in my own experience, every plant manager who has arrived at this culminating point

in the development of a cost system has not only gone through a course of education as to the possibilities of improvement in his factory that has already saved him all the money spent on the system, but has had opened up for him possibilities of the future which are alluring from a profit viewpoint. But from the mere point of view of intelligent knowledge of the situation such a system is worth while.

Let us see, however, how the trial balance and sub-statement match with the elements of the philosophy of costs as outlined previously.

They furnish, of course, the proof of the situation. The only possible error lies in the raw-material accounts. The amounts used may not have been reported properly, in which case the trial-balance showing of these items may be greater or less than an actual inventory will show. Fairly frequent inventories, during the year, of one class of raw materials at a time, and other checks discussed under the head of materials, may be applied until these errors are remedied and avoided.

The imagination, the visualizing of shop conditions, has ample opportunity here. The whole situation of the plant lies plainly bared—the condition of the finances, the amount of money tied up in raw materials, the strength and weakness of the different classes of work from the profit viewpoint. In the matter of Class B, for example, it is apparent

that the practical instinct has ample opportunity for its exercise and need of action.

The standards must be furnished by the executive. They will quickly occur to the mind of the watchful executive. To discuss only those applicable to manufacture, the following will appeal as important:—a standard of values of raw material of each class to be kept on hand in relation to the amount of business done; the amount of money tied up in work in process; the proper percentage of profit obtainable in each class, etc. These standards fixed, the variation of the actual figures from them will stir the executive to investigation and action.

As to the element, comparisons, this of course is the life of the trial balance. Each month, no matter how pleasing it may be in itself, tells of progress only in relation to the others; and in the sub-statement, Form 2, not only may comparisons of months in black ink be had, but by the figures in red ink, the period to date shows the average progress made in each class.

But without arrangement all these values would be difficult to obtain. Rapidly the executive compares his quick assets and liabilities. His permanent assets and liabilities tell their story together. The manufacturing results lie stretched out before him. The sub-statement is a concise history of his classes of manufacture.

As to periodicity, the trial balance must be produced quickly, and generally can be, within a week after the end of the month.

As for co-operation of the organization, that executive would be foolish who would hide the condition of Class B, as shown in the sub-statement, from those subordinates who could help remedy it. Common sense demands that he seek their co-operation to better this condition if possible.

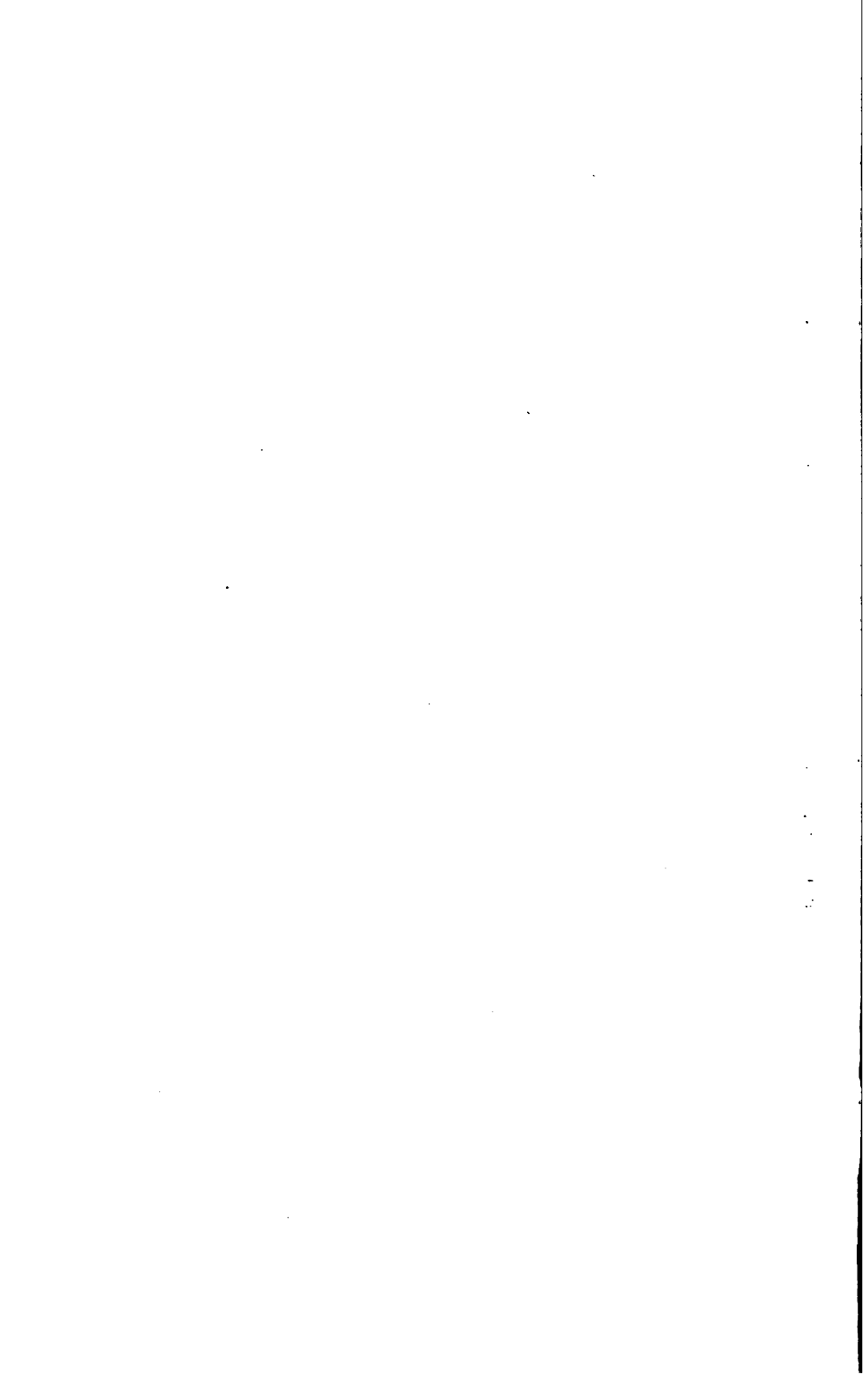
For plant control and operation, while of course the further detail is essential, nothing could be more advantageous than this trial balance as an indication of the points of need of action.

Many executives who desire such a showing and do not possess it will wonder if it really can be produced monthly. There rest in my mind the names of at least half a dozen plants where it exists in successful and accurate practice, and is accomplishing all that is expected of it. Of course, the forms shown may be varied in different businesses, and there may be certain other items of enlightenment under the various main heads that may seem desirable to add. These things are at the discretion of the executive.

Such a trial balance is always an easy one to obtain in all concerns where the work is done on order numbers or lot numbers. It may be said, however, that it does occasionally happen, in a plant producing small and varied staples, and in which the labor

and waste situation is under good control, so that the costs of articles do not vary very much as to labor and material, and perpetual inventories are kept, that a trial balance not so final in its results may be satisfactory. But it will always be realized by the executive with the grip of this perfected trial balance on his business, that he can safely have other worries in life than those of his business; and it should be, to those who do not possess it, a proper ideal of attainment in their businesses, not merely because of the periodical story it tells, but even more because of the struggle, and the re-forming and refining process their plants and organizations must go through, to arrive to it.

THE COST OF THE SALABLE ARTICLE



CHAPTER III

THE COST OF THE SALABLE ARTICLE

ONE of the first results expected of a cost system is that it shall present the cost of the salable article as a basis of knowledge. This knowledge is valuable, not necessarily or properly only for the fixing of a sale price, because competition has frequently already done this, but for the purpose of discovering the profit or loss on the article as manufactured under the particular conditions of the plant, with the intent on the part of the able executive of altering the conditions, or the quality, or perhaps even the method of sale, where the sale price cannot be changed, if the facts of the situation demand it.

But in obtaining this cost two very important modifications must be borne in mind. In the first place, if it is to be depended upon it must be a proven cost. Its total added to the totals of the cost of all other articles produced in a given time must equal the grand total of all expenditures whatsoever of the plant in that time.

In the second place the cost, to be of the utmost value, must be either the cost of the article produced at any or all times, or must be compared with

the costs of the same article at all other times within a reasonable period.

The cases of absolute business failure are innumerable where figures, presented as a representation of cost, are accepted without proof and acted upon, or when proved, represent only special effort; and even such cases today are much too common. The mariner entering an uncharted harbor, judging the shoals by the color of the water or an infrequent sounding, has as good a chance of reaching safe anchorage as an executive using costs without these modifications has of properly establishing his business in a closely competitive field. It is purely a matter of luck.

Many cost systems fail of completeness and of proof because the work is undertaken from the wrong point of view. The costs of articles are gathered with the expectation of adding them together to equal the total expenditure, whereas the simpler, easier, and proper method is to divide completely the total expenditures—in their three main divisions of material, labor, and expense—over all articles in the course of production periodically, that period generally being one month. This latter method starts with the total and the proof, and works out into the detail. It involves first of all that there be arranged methods whereby the total used of each main division—material, labor, and expense—shall be completely and accur-

ately gathered and proven so to be. Too much stress cannot be laid upon this point in considering the structure of a cost system. The further division of these totals into article or order costs is a much simpler thing to accomplish, for the first task involves co-operation of the management, generally physical re-arrangement, and some persuasion or coercion of the human element, while the second involves merely ingenuity and patient training of the human element.

The building of a cost system may be not inaptly compared to the building of a house. When the three main divisions—the cellar, the roofed frame, and the walls of the rooms—are finished, the final completion is plainly in sight and ingenuity and patience will complete the house.

As has been explained, the cost of an article varies at different times of manufacture, sometimes quite materially, and it is therefore needless to point out that its true cost is not what it is produced for in good times, in bad times, or the first time, but what it can be produced for in the ordinary average routine of shop practice. Only an accumulation of different costs, or a constant record, or at least the record of all variations from the standard, will give a surely dependable figure.

The executive is first interested in the cost of orders as they are shipped, if his work is special and done on order numbers, or as produced, if his

articles are staple and small articles produced in large quantities. He should desire, then, as a part of the routine of his work, to have these costs placed before him regularly. He wants them concise, compared with a standard and previous duplications of the same article, and should desire detail presented to him only as he calls for it. This latter is essential for the conservation of his valuable time.

TOTAL
MATERIAL

344.

387.

732.

Imagine, then, a plant operated by order numbers, *i. e.*, all work being done on definite orders, consequently numbered. As these orders are completed the manager, should he have a right cost system, finds on his desk in whatever form may seem most agreeable to him—cards or a loose-leaf book—such a sheet as Form 8, Executive's Order Cost Record.

In the form shown, the cost is of a large unit; but it is very apparent that in any case where the work is done on an order number the size or quantity makes no difference in the form of presentation, and it is equally understandable that the executive may have whatever divisions of material, labor, and expense into classes he may desire. Common sense will dictate, however, that he have presented to him only the fewest sub-divisions of the main divisions of material, labor and expense, so as to observe their variations from the standard and as between different orders, and when these

FORM 3-EXEC

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variations attract his attention to the point where his interest or the needs of the situation demand further detail, he can then refer back to the origin of the costs, namely, the cost sheets of the book-keeper (for this method of cost is best operated as a part of the book-keeping system) shown in Form 4.

Here is shown the detail of order cost in whatever form it may be reported—the material from requisitions or stores reports—the labor from payroll or time notes—the expense from the expense analyses—all to be illustrated later. Here it will be observed also that labor and expense are given by departments. It is almost needless to point out here that figures and letters are used to indicate classes, departments, and items of material which in actual practice may be replaced by any significant names or signs that the circumstances and clarity of the situation may demand. Nor does the question whether it is better to arrange the figures vertically or horizontally need any answer. It might also be said of these forms that they are purposely not specific, but as long as the principles that they represent (as discussed later) are adhered to, no difficulty will be met, although they represent the result of experience. But cost clerks are human beings, and they will have their little forms and methods which the executive will find it wise to put up with, as long as he loses nothing in ac-

curacy, clearness, and speed of presentation of the situation.

Form 4 shows the detail cost of the order. Form 5 shows the cost of a single part. The relation between forms 3, 4 and 5 is worth noting. Form 3 is the condensation of Form 4, this latter being the method of gathering or picking up of the detailed costs of the order from the material requisitions and the payroll or time-notes, with expense added, while Form 3 represents the totals presented to the executive. But both Forms 3 and 4 represent the total order. The executive may frequently want to know the cost of parts of the order. Form 5 represents a way of gathering this. And right here may be reiterated an important point. Many concerns when they desire to get the cost of an order or article attempt to get the cost of every separate part, add these together, and thus get the whole.

While this is on occasion a practical thing to do, it is most frequently simplest, most economical, and most practical (especially where the trial balance showing the monthly profit and loss is to be obtained), to operate as shown: namely, to get the cost of the whole order or lot, condense from that to the executive's order cost and complete trial balance, and then analyze from it the cost of parts where desired, as shown in Form 5. By this means no desired detail need be lost, and yet the success

and values of the final showing are not jeopardized by frequently overwhelming detail.

A few words are necessary concerning Form 6. Forms 3, 4 and 5 form a sequence relating to one style of work done on order numbers and especially to the connection with Forms 1 and 2, the trial balance.

Form 6, however, is presented for the situation of small staple goods where the detail is somewhat different and where, dependent on the control of the shop methods, the cost of every lot may or may not be obtained. It is, in the majority of cases, much better that every lot should have its cost discovered, but there are cases where, for staple articles constantly repeated in manufacture, definite measured quantities of material are always started through the factory, and where the labor is all piecework, when a constant and careful record of waste and expense fluctuation will give the absolute variation from the standard, and in these cases it is frequently sufficient in a well-managed shop to get the cost of the articles periodically. This is, however, true only when the whole shop situation is under close control, and should be generally avoided for best results.

How, now, does our philosophy of costs apply to Forms 3, 4, 5 and 6, order and article costs?

The practical accuracy of these figures is guaranteed by the trial balance already shown, but ma-

terial, labor and expense are separately handled and proven in total, as will be seen later. They may then be accepted with confidence.

Imagination to visualize the actions recorded by the figures in all these forms is absolutely essential to their understanding. It is necessary to the executive to educate and to strengthen this imagination, or to bolster it, by study of the articles manufactured, and to familiarize himself with shop conditions. He will then more readily understand the meaning of the differences in the costs of different orders. Without imagination the differences will be recognized, but an attempt to solve them leads to much investigation and lost time. This value to be obtained from the use of imagination in cost interpretation cannot be too seriously considered, since it lies at the root of the whole manufacturing situation; first, in that it involves on the part of the executive a thorough intimacy with the character, arrangement, and value of his plant units, and, second, in that it lies at the base of proper cost understanding.

In the remedy of these differences, practical instinct comes helpfully into action. Imagination having visualized the conditions under which the orders were manufactured, and the reason of the differences being known, practical instinct suggests remedies toward more closely approaching the standard.

The standards are fixed in each case by careful estimates based on the plans of the work and the shop conditions, and offer a silent criticism which is healthy in its urgency of standardization of shop methods and watchfulness.

Essentially, comparison here is the life of the system, and the arrangement of Forms 3 and 6 makes it quick. Comparison brings out especially the wastes of material (for it may fairly be said that any material use over right estimate is a waste) and the differences in labor (which latter may be and generally are due to lack of control of this element in the shop—more often than they are due to a failure to estimate properly).

Besides the arrangement in Form 3, which offers to the executive a quick glance at the situation on the completion of each order, it will be further noted that as the executive desires it, Form 4 offers, at his call, further detail of each order, its use of material, and its cost occurrence in the different departments, and as desired Form 5 offers the means of getting the cost of any part of the whole. This arrangement makes the work of the executive easy and effective.

As to the periodicity of time of presentation of these order or article costs, they should necessarily be as promptly closed and presented as possible. Nevertheless in active practice it is generally sufficient to close them up once a week when the payroll

is finished, especially on articles of production under good control in manufacture. The new, the losing, or the doubtful orders should have their cost brought forward as soon after completion as possible, before the memory of the details of the situation becomes obliterated.

As for co-operation of the executive organization, how can any executive looking at Forms 3, 4, 5 and 6 with the hope and expectation of changing them for the better even have the courage to attempt it without the co-operation of all along the line? And how can he get this better than by showing the facts to them as presented here? It is true, however, that as far as these order and article costs are concerned there will be no need of showing to his force any other figures except the material and labor costs, since the expense figures are not changeable from a study of these sheets alone. Thus the executive can obtain co-operation in a practical way without presenting the final facts, should he desire not to do so.

In this matter of organization co-operation it has often proven valuable that the executive should keep his sales force cognizant of the cost situation, since it is too often the tendency of a salesman to yield, in bidding, to the pressure of competition or those exigencies which appeal to him in each particular case, even to the point of taking orders at a loss needlessly.

T L
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16

TAL

Article ST		STANDARD EST For 1,000—8.	
ITEM	UNITS	PRICE	
Material A	806	\$0.02	
B	40	.104	
C	5	.10	
D	800	.01	
E	100	6.22	
Total Material		per 100	
Cost per 100			
DIRECT LABOR			
Operation, General			
1 in Dept. 1		\$5.75	
2 " " 2		1.00	
3 " " 2		.82	
4 " " 2		.96	
5 " " 3		1.25	
6 " " 4		1.18	
Labor Expense, Total		10.96	
" " per 100		1.14	
Selling and Adv.		10.00	
Total Cost		78.62	
Cost per 100		8.15	
Number Started		1,000	
Number Finished		965	
Per Cent. Waste		3½	
Date Finished			
Time Allowed		2 weeks	
NOTE. o articl a simple 3			

This method of order costs need not be confined merely to salable articles. The executive at his will may put forth orders for any improvement or shop work with this plan, and at its completion get returned to him its true cost.

Here is presented, then, the result of a simple, easy, workable method, the possession of which, in its presentation periodically and completely of the cost of all salable articles, gives to the intelligent and active executive that sure and confident grip on his manufacturing situation which must keep him moving in the right direction constantly, must steer him safely away from those mistakes of ignorance and carelessness which are great profit consumers, and which can become a great element in keeping his organization keyed up to the highest manufacturing pitch.

**THE ECONOMIC CONSIDERATION OF
MATERIAL BY COSTS**

CHAPTER IV

THE ECONOMIC CONSIDERATION OF MATERIAL BY COSTS

IT may be well, in considering material as the first of the three main elements of cost, to define what it means from the cost point of view. Material, as a cost term, includes only that which becomes a physical part of the finished article. Any other material necessary in the course of manufacture, which does not become a part of the finished article and cannot be charged to it as an integral portion, is not to be classed as material from the cost point of view, but falls under the head of expense, generally as a supply.

It is not to be implied by this explanation that any of that which is physically material, but is not so considered from the cost point of view, ought to be handled in manufacturing practice necessarily differently or with less care and consideration than that which is material from both points of view, but that its use from the dollar and cents point of view does not bear the same relation to the final article cost. Unconsciously the executive handles it differently, even when he has no cost system nor any cost-system understanding.

Since this is really important from the standpoint of true economy, it may be well to illustrate it with the case of a tool manufacturer who manufactures all sorts of tools to make the work of mechanics easy and accurate, and in his advertisements advises the use by others. Having established his designs, he, of course, furnishes his men ample amounts of material from which to manufacture them. He has no hesitation in doing this because he figures that this material in a round-about way, as it is shaped into the salable article, is being converted into dollars in the bank. But he fails to furnish his men with adequate benches, modern lighting facilities, up-to-date tools which he may not manufacture. These latter are equally material from the purchasing agent's, and the concrete, point of view, but their connection with the return on the investment is not so direct and clear. One class of material gets all the thought and attention that the kind of business demands. Its application is direct. The other class of material gets frequently little or no study as to its use and value. Its application is indirect.

Cost consideration makes this point of view of directness and indirectness the dividing line, so that, in the classification of material as the first element of cost, only material of direct application as a part of the salable article becomes a matter of interest, all other material receiving attention as a

part of the third element of total cost—that is, as a part of expense.

Now material is the simplest of the cost elements in its application, and yet one of the most difficult and expensive to gather record of accurately.

Its simplicity lies in the very fact of its concreteness, its visible use in manufacture, and the directness of its application to a particular finished article. It is always before the eye in definite form and with a predetermined and distinct destiny, and can be measured or weighed at any time.

Its difficulty and expense lie in the fact, that, despite this concreteness and visibility, it requires numerous and sometimes costly safeguards to get the quantities used and remaining on hand accurately recorded, and balancing with the facts of the case.

In this respect it entirely differs from the two other elements of cost, labor and expense, which lack concreteness and constant visibility, but can be absolutely accounted for to a penny in total used weekly and monthly, except in the part of expense where material enters as a supply.

In cost keeping there can be very little quarrel as to how to apply material in article costs. Reports of weighed and measured quantities are always chargeable directly to an order or article. The difficulty in devising methods to make sure that a correct report is made of all material used, is of two natures, physical and human. While it

is true that the introduction of proper methods of receiving, storing, and issuing raw materials, and taking care of finished and semi-finished parts, demands an outlay of money in storerooms, clerical attendance, etc., it can be safely stated that such equipment invariably returns full value, in a reasonable time, in the savings made through minimum investment in supply of material to satisfy the demands of manufacture, because of certainty of knowledge of supply on hand, promptness of delivery, and saving of waste. From the viewpoint of getting accurate reports of material for costs, of course, such an equipment is invaluable. It will largely solve the physical difficulty of gathering costs of material since it readily permits a definite record of its movements and disposal.

The human difficulty is also somewhat avoided by this equipment, but not entirely. There should be in every well conducted plant a definite watchfulness of the question of wastes of material, for it is here that the human difficulty arises. Operatives, through carelessness, accident, or of natural necessity, will spoil material, and in many cases even dispose of the waste surreptitiously.

There are three factories in mind where discovery was made that this complete loss of material amounted to many thousands of dollars a year.

It must be remembered that the material cost of an article is not obtained by dividing the total cost

of material issued on the order by the number of units started with, but by the number of units finished and delivered, which, on account of waste, most often yields a very different result, and this fact necessitates a careful record of the progress of material and the wastes made during its progress. But a point of even greater value here is that all the wastes should be thoroughly known, so that they may be kept to a minimum.

Every plant has enormous wastes. Some of these are difficult or apparently impossible to eliminate. Some naturally take place in the right attempt to reach reasonable and high standards of quality. Yet all should be carefully watched and fought.

The waste of material is one of the great crimes of the ages. We suffer from this fact today, and our descendants will suffer still more. We eat too much. We are careless in the use and preservation of all kinds of material.

This waste is one of the largest of the reasons of the high cost of living. And there seems to be no great movement in the world to fight this waste, except in a few cases, because the tendency to waste is too deeply inbred, and because we have few good statistics, or standards, as yet to show the volume and percentage of it. But every good executive should furnish himself with the statistics in his factory, and should use his cost system to fight this tendency.

There are in all factories several kinds of waste. There is, of course most prominently that which naturally occurs between the raw material and the finished article. It is principally of four different kinds and in all kinds of work it can be reduced by very careful study.

First, the design may be altered, for it is true that many articles are manufactured from designs not scientifically worked out. In making this alteration, of course, it would be folly to do it until after all questions of quality, strength, shape, and durability and the necessary factors of safety, had been properly considered. This waste through wrong design cannot be shown an executive by any tables. He must simply recognize the necessities and values of the case and engage the proper abilities, if his staff does not include them, to accomplish this economy. It is of course as false an economy to skimp the material in the finished article, and thus to build a reputation which will eventually decrease sales, as it is to make the product too heavy by a guess and a determination to be on the safe side. Frequently experiment may be necessary in the final determination. In a staple article to be continuously produced, the cost of the experiments would generally be small in comparison with the value of results. Where this waste occurs it involves in time the loss of a very large amount of money by its constant repetition.

A second form of waste of material comes through improper purchasing, natural shrinkage, changes in design at inopportune time, leaving on hand specially shaped or sized material, or through those errors in judgment or calculation which leave on hand useless or obsolete material. A mistake that the executive generally makes in the matter of this material is that he lets it lie around indefinitely in the hope that some happy day may dawn when a use can be found for it. It is generally, however, the wisest thing to dispose of such material at least loss, and to charge the loss to general expense. A periodical survey of the list of material on hand will discover this waste.

A third and principal point of waste occurrence lies in the natural reduction of the original raw material in its progress toward the finished article. Many executives, considering this waste natural, pay little attention to its volume. But there lies here, as observation has again and again proven, large opportunity for economy.

A fourth method of waste occurs in the spoiling or loss of units of production in progress, through carelessness, the development of unexpected defects, processes gone wrong, or by the many difficulties that beset the manufacturer of the perfect article.

It is a simple and natural corollary of a right cost system that proper records of waste should be gath-

ered and shown. Forms 7, 8, and 9 indicate styles of reports that every executive should have regularly laid before him.

It is not possible to make a standard form of waste report that will fit every business. Each business must display in its own sequence of operations where wastes occur. In a business like the metal trades in which the finished article comes out of a purchased shape, or from a commercial form suited to its production, the style of Form 7 may be used to show waste in progress of manufacture, but it may be varied all the way from showing waste only between raw material and finished article, to showing it at each operation, or by departments.

In a business where the materials are mixed in mass and change their character as they merge together, the style of Form 8 may be used for the same purpose, and again with such variations as from raw material direct, to finished article, or by departments, or operations.

Form 9 illustrates a possible method of waste record of spoiled work where integral parts are started with. Form 8 may be elaborated for the same purpose where the production is in mass. Such analyses if followed closely will always develop large economies. But it must be understood that it is generally not enough to know merely that there is a definite loss. The reasons therefor must

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be classified and studied in order that remedies may be had.

These forms are shown merely by way of example. No intelligent and economically studious executive will be long in discovering the practical way for his business. By the practical way is not meant, however, the easiest way, but the way that brings out best where the wastes occur.

It is not good logic to argue, as do some executives, that it is needless to keep track of the waste where it is of no value. It must not be forgotten that waste, valueless as such, cost money when it was purchased as raw material and would be worth money if not wasted. Records thus kept of waste will eventually permit the creation of proper standards of maximum and minimum by which to work.

It may not be inappropriate to point out here, that, once right standards are fixed, the intense co-operation of operatives may be obtained in reducing actual waste to them, by a form of bonus, just as quantity per hour is increased. The method has been explained in an article in *The Engineering Magazine* under the title "Quality Piecework."

A great many cases of waste study, and marvelous savings therethrough, might be given, and they would undoubtedly make this chapter more interesting; but the thinking executive will generally have no difficulty in calling to mind some instances

in his own experience, and even a slight one should urge him to widen this experience to the utmost, for any investigation in this direction always pays large dividends.

It is often necessary in the study of waste reduction to collect the waste physically, separately as to classes or articles, as well as to possess its statistics. There is in mind one plant, making many small parts, which established a "bone-yard," where weekly are displayed all spoiled parts with a tag showing how, where, and by whom spoiled, and to this are first led the foremen and they in turn lead the culprits. The result is very satisfactory. The study of waste is a vital element in factory economy.

Of course in the proper gathering of material cost, the purchasing department plays a large part. It must furnish simple but complete records of raw-material unit prices. Now it is the province of a purchasing department to get the greatest value for the least money. But it is very true that the cheapest materials per unit of finished product are not necessarily the cheapest materials per unit of raw material. The purchasing department, then, should keep in touch with the waste reports, because from them it may well discover the most economical material to buy. Of course, into this consideration also comes the question of the quality of the finished article.

Since it seems not to be a very well known method, though a very simple one, of connecting the material reports with the book-keeping accounts, as well as with the order costs, Form 10, a material journal, is shown here. No lengthy explanation will be necessary. As is apparent, the material, as reported, is credited to its proper raw-material account, and debited to the class of work in which it is used under the head of "Cost of Work in Process." The order number is shown, so that for order costs, perpetual inventory of raw materials, and book-keeping purposes leading to the complete trial balance, this material journal is effective.

In the perpetual inventories of material in dollars and cents which appear under the head of "Raw Materials on Hand" in the trial balance, lie the crucial tests for accuracy of the whole cost system, for, as will be seen later, the other elements of cost, labor and expense, are readily proven weekly and monthly as to their accuracy in the total cost.

It will be observed that these figures of Raw Material on Hand are obtained by starting with an actual inventory, adding monthly purchases, and deducting monthly the amount of material reported used. Making the fair assumption that the inventory to start with has been taken carefully and accurately, it will be recognized that the only source of error lies in the reports of used material.

Now despite all precautions, it is with difficulty that the dollars and cents total of material used monthly is accurately obtained. Carelessness in measure and weight, surreptitious extraction of material to replace spoiled work, occasional theft, unavoidable wastes by shrinkage, etc., changing prices on different lots of the same material, make this task one of difficulty to which the executive should give some attention. He will in the end be able to remedy them.

Of course proper means of storing and issuing materials present the greatest remedy. Checks by careful observation of the costs, and at the end of different lots as to balancing of amount purchased and amount reported used, will show other delinquencies. The addition of definite percentages based on careful experience and observation will correct many shortages due to material shrinkages, for it is well known that many substances, such as coke for example, will weigh into a car an appreciable percent heavier than they will weigh out.

To help such a situation out, materials should be arranged and kept track of in the book-keeping by classes, and if narrowed down to reasonably small ones, as experience dictates, actual inventories and checks as particular lots disappear, will in time bring accuracy of stock actually on hand with book values, so that the latter may be depended upon, and total accuracy assured.

And this is very definitely a matter in which the executive should interest himself, because it involves definite losses through wastes, and its proper solution invariably leads to larger profit.

The application of our philosophy of costs will not at first seem so plain in relation to this subject of material, yet it is extremely important.

In accuracy, material cost should be absolute because of its direct application. Nevertheless there arise many cases, as indicated, where in practice this does not prove to be true, and we are here forced back upon practical accuracy or accuracy of total cost. For when material is discovered to have disappeared with no knowledge as to what order or article it is chargeable to, or to have become obsolete, then we must fall back in actual practice upon some practical, even if not theoretically right, way of getting it into costs, such as adding it as a percent to the material costs of those articles which use the disappearing material, or putting it into expense, where it will be divided over total production, as circumstances may dictate.

There are those who advise that the cost of work spoiled in process should be a charge, not against the particular order or article, but against the total work through additions to expense; but this is a very arguable matter, and it would seem that more is to be gained in the long run by letting each class of work stand for its own misfortune.

Imagination to visualize the facts of use and waste of material from the figures, and practical instinct to detect the weakness and the remedy are of course essential.

In fact, imagination in the consideration of material helps to simplify and beautify the whole manufacturing proposition. It can lure up the picture of the raw material, its course through the cohort of workers, changing its shape and form, sloughing its natural wastes as it is touched into a thing of use and profit, while practical instinct follows it to see that the purchase is of best quality and price, and that it progresses with minimum waste and effort. It can bring forward constantly the sad consideration that since raw material in most factories is merely the finished product of previous labor, its waste is not merely the waste of the material itself, but the setting at nought of the earnest work of many hands that have brought it thus far on its way to final usefulness. The cost figures furnish ample basis with right standards, for the practical exercise of these elements of the philosophy of cost.

Standards, especially of waste, and of stock on hand, are, in the matter of material, peculiarly valuable and necessary. Waste of material in factories is so large, so usual, and so essential, that, without carefully worked out and insisted upon standards, all concerned are liable either to become



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RAW MATERIALS ON HAND

d, and charged to Manufacturing or Cost of
s used. This record, written up daily or
lues in cost records and bookkeeping.

satisfied and indifferent, classing the waste made, whatever it may be, as a necessary corollary of manufacture, or, if the manufacturing conscience of the executive be tender and his horror of waste great, the attempt to reach an impractical minimum becomes more expensive than the waste.

No one will dispute the necessity of comparison. Progress in any direction fails to show without it.

With such a mass of figures as the question of material and waste presents in factories, where attempt is made to follow waste carefully, most value is lost without proper arrangement, for the weakness must be quickly seen.

Periodicity becomes vital in its necessity for promptness. Wastes should be known and presented as soon as possible after their occurrence. Where the work is large a daily report is advisable. Where articles are small, or the product is in mass, the knowledge can generally and most practically be known as the lot passes completely each operation.

There is no element more vitally valuable than co-operation of the organization in the matter of care of material, and consideration and watchfulness of waste. There is no reason why such records should not be open to everyone concerned, and indeed great attention should be paid to impressing these figures upon them. Everyone concerned in manufacture works better with a goal,

an aim, a standard toward which he may and must continually strive.

To recapitulate then, the cost consideration of material leads to economies through:

The proper purchase of material.

The proper care and issue of material, and studied corrections at points where errors are liable to occur.

Scientific design of product.

Care that material shall not become obsolete.

Watchfulness of waste of material between raw material and finished product.

Watchfulness of waste made by spoiling units of production.

Much attention has been given, in discussions of economies of management, to the elements of labor. A proper conception of the element of material, however, as the basis of all labor, as the element, springing only from natural sources, which labor shapes into forms of use and beauty, the cheapness and plentifulness of which make for the happiness of the whole, and the waste of which is to abuse instead of to bless nature's bounty and the work of our fellowman—if this conception could be universally held up, highest speed of production and maximum prevention of waste would not be ideals still so far from accomplishment. But

taking the situation as it is, the intelligent executive will supply himself with the best safeguards in the handling of his materials, and, with set standards, use his material costs and records of wastes, proven and in ample detail, to keep himself and his organization working steadily toward the best results.

LABOR FROM THE COST VIEWPOINT

CHAPTER V

LABOR FROM THE COST VIEWPOINT

ONE of the complaints of labor is that it is viewed too much purely from the cost point of view, yet this is one of the natural outcomes of the struggle for economy and efficiency.

Material, the first element of cost, is an inanimate thing, subject in its use to the intelligence and carefulness of labor.

Expense, the third element of cost, is built up around labor for the purpose of assisting its effectiveness, and guiding it.

Labor is therefore central in the trio of cost elements. It is an element of anxiety to the executive, in that it is the only element of cost whose movement, whose effectiveness, whose control, does not seem to be readily under his will.

But what makes it of the largest interest to the executive is that it is the most elastic of the three elements of cost, and the one whose control permits the greatest economies, increase of volume, and steadiness of operation. For this reason most of the discussed methods of management centre around labor. But equally for the same reason it is important that the executive have definite and

close information from his cost system concerning it.

For cost purposes, labor divides itself into two parts: direct labor, or that which can be shown to have a direct relation to a particular article of production, and indirect labor, that which is general to the whole production. This latter becomes, through its indirectness, an element of expense, and ceases to be considered as an element of cost under the caption of labor; although, of course, in the question of economy, it deserves (although it seldom receives) as much attention as direct labor.

Labor is the simplest of the cost elements in its application and proof as to the total costs. It may be somewhat difficult in certain classes of work to get the time of operatives exactly apportioned to the different articles of manufacture, but it is not difficult to divide all labor, weekly, between direct and indirect, and to divide all the direct labor over the total production.

The difficulties of obtaining a proper apportionment of direct labor to units of production are almost entirely human, however. There is a somewhat natural hesitation or antipathy on the part of operatives to having their time on different operations exactly measured, because of the fact that the information will be used in criticism of them. The inevitability of necessity eventually takes care of this difficulty.

There is considerable hesitation on the part of the executive to supply either apparatus or clerical labor sufficient to get the facts of labor operation, until he has learned from experience that, when the facts are obtained and properly utilized, the expenditure is fully warranted.

There is finally the opposition of the foremen to having their departments (to use their own phrase) "turned into book-keeping departments." This opposition, however, can be quickly banished by education, and the application of that element of cost philosophy, co-operation, will readily turn it into enthusiasm for the record in the case of any good foreman.

It will do no harm to repeat here that the best way to gather the facts of any complete costs is to start with the total, and analyze to such details as are desirable, and not to gather minute details with the idea of adding them together to a proved whole.

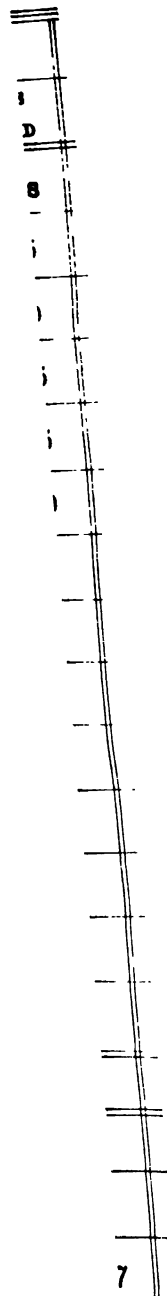
In the getting of labor costs, therefore, the weekly payroll may be taken as the proved whole and analysis therefrom will give any details desirable. The payroll can be made to tell a good deal more about labor than it usually does. Ordinarily it is used merely for the purpose of paying wages periodically. But important uses can be made of it, both from the point of view of the executive, and of the cost clerk and book-keeper.

Form 11 indicates a method of payroll which offers many advantages, especially for a plant doing its work on order numbers, or in lots. As is apparent from a perusal of this form, the whole story of each department is told—the workmen, their numbers, their rates, what they received, any deductions, what they earned, whether their work was indirect or direct, if direct, on what jobs, how many hours worked on each job, and what was the cost. This is almost the whole story, and a continuous record made from week to week offers the executive ample opportunity to consider the situation in any department, to consider the relation between direct and indirect labor, to know just who worked on a given job and for how long. It offers the executive the opportunity of a further analysis of his labor, when the labor costs as shown in Executive's Order Cost, Form 3 and the costs in Form 4, are not satisfactory or in sufficient detail to tell the story, just as Form 10 offers the opportunity to get a further analysis of material. It offers what every cost record should offer, a picture of the situation.

But this payroll offers also to the cost clerk and book-keeper ample information. The payroll of course proves the labor cost as charged to all orders each week. Its weekly totals can be used for cost-sheet and book-keeping entries, and, as shown at the bottom of the form, they can likewise be used

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Machine	Worker	Number Started	Number Finished	Time	Rate per Hour	Cost for 10	Worker Earned
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		96	96	4 $\frac{3}{4}$		14.8	
		92	92	4 $\frac{1}{2}$		15.3	
94	9	98	95	6	25c	15.8	
		100	98	5 $\frac{1}{2}$		14	
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work, or under any

as the bases for adding expense to orders, which items can then be entered in costs and book-keeping at the same time labor is entered. When departmentized, such a payroll, even in a large plant, offers practically no clerical difficulties, but it does offer a proved and complete record and a history, by order numbers, of each man's work—the time notes being the next and final step that can be taken in this analysis of labor.

It does not, however, offer to the executive what he must have in his effort to control labor cost—a detailed criticism of operation time and cost. For it goes without saying that the only manner in which labor can be effectively brought to its best economic state is through the study and control of its least and simplest operations.

Form 12, however, offers a simple and effective means of information on these points, and just as the payroll pictures the situation as a whole, this record pictures the intimate detail of each man's work.

Here are seen the date, the man, the machine, the article worked on, the operation, the time and the cost, in comparison with the standard and other records. Here can plainly be observed delays, good records, the results of proper pre-arrangement, the values obtained by incentives, the variations of men and machines. Also, when the work is paid on some of the incentive methods, the

earning power of the man on the operation is shown.

In the plant operated under ordinary methods these records are ample, and, for purely cost purposes, complete. With slight variations they may be made to show the facts of the case plainly under any method of labor payment.

The operation of our philosophy of costs is not difficult to construe in respect to these labor records, but a slight recapitulation will show its extreme importance if the executive expects to get results from his labor costs.

In these records practical accuracy is of course assured, since each week, more particularly in the payroll Form 11, a complete division of all labor paid for is made to indirect labor as an expense item, or to some order number.

Imagination and practical instinct, which in service go hand in hand, play a large and efficient part in considering these records. This is necessarily so on account of the elasticity of this element, labor. Without imagination to visualize the events and conditions pictured by the figures, to gauge the element of human nature and effects upon it and actions prompted by it, and without practical instinct working to conclusions from this conception, labor costs, offering such large results from their study, are somewhat useless from the point of view of shop control; and it must not be

forgotten that costs are more important from the point of shop control than from that of price fixing.

But with these elements, which are really the attributes of a good administrator, in active operation, such a record as Form 12 will unquestionably force the executive to institute some of the modern methods of incentive to labor, in order not only to reduce but to make steady the labor costs and to bring about their approximation to the standard.

In the matter of standards, of course, scientific management has made clear how these may be set with motion and times studies, and it is inconceivable when the possibilities and elasticity of labor are realized that any other standards than these, worked out with a close and careful study of all conditions and necessities, should be considered. But it must not be overlooked that it is futile to work the standard out on one basis and attempt to do the work under other conditions, if it is expected or desired to attain the standards.

Without comparisons, of course, Form 12 becomes useless. There is always in a factory of any size such a multiplicity of labor operations, orders, and labor cost units, that without simple arrangement, the facts of the case (for any purpose of economy or control) become no better than a series of figures mixed in a lottery wheel. Arrangement is the very life of their use. The executive must

be compelled to scan detail only as it seems desirable.

In any duplication of work prompt periodicity is essential, but in every case, especially in Form 12, the records should be presented in the shortest time after the occurrence so that conditions may be known.

Co-operation of the executive organization becomes in labor costs a large asset. With the multitudinous operations occurring all over the plant, that executive would be, to say the least, very ineffective, who did not see that the records were freely displayed to as many of his staff as have oversight of the work, a controlling mind, or an ingenuity in device, mechanical or human. For, because of the great mass of detail and the large possibilities that lie in labor, of saving and of loss, of energizing or of relaxation, the best results can be obtained only through co-operation of the whole executive organization. Thus the application of the elements of philosophy is especially essential in consideration of this element.

Of course, as is true of any fact shown by costs, the showing of labor from the cost viewpoint can be of value only as it forms the basis for action. Not alone, however, do these labor-cost records have a definite and moral effect on the organization and the operatives, in that, knowing that the times of operation and production are recorded

and compared, they will endeavor to make these records speak favorably for themselves; but if they come under the eye of the executive, the variations of the records will force him in the end to seek and maintain modern methods of arrangement, of assistance and incentive to labor, in his desire and attempt to study and reduce costs.

An important reason, of course, why it is especially valuable to reduce labor cost is that, since expense cost per unit of production varies with the labor cost on principle, as will be discussed later, when labor cost is reduced in proper ways, expense cost likewise goes down. Thus it is especially important to watch this element, in that its control affects two of the three elements of cost.

But the element of labor is particularly one of which ample, yet simple, records should come before the eyes of the executive and his organization constantly and promptly, not only because of its elasticity and because of the fluctuation of the element of expense with it, but because it is a human element with a reasoning ability, readily susceptible to the moving power of facts, but very unbelieving of statements made of itself, unbacked by the proof of truth.

The wise executive, anxious for improvement in this most important element, then, makes no mistake in appreciating the necessities and peculiari-

ties of human nature, provides himself freely with the facts, and submits them willingly and confidently to his executive organization. But still further he will make no mistake in taking into his confidence, as far as seems necessary, the actual manufacturers of these records—labor, itself—so that, understanding the reasons and values, and obtaining, under a wise management, a part of the reward, it may produce results not merely worth while, but sometimes unbelievable. But the record is the first necessity.

THE VEXING QUESTION OF EXPENSE

CHAPTER VI

THE VEXING QUESTION OF EXPENSE

EVERY executive can understand the relation of material value to unit production cost, and thinks he can control it. Its application is direct. Every executive can appreciate the application of labor charge to article cost, even if he has not developed methods that control it. But when the vexing question of expense arises there is a variety of opinion as to its application to unit costs. Who shall devise a non-disputable way to apply the salaries of the executive organization, for instance, as an item of expense to each unit of production, when many of the units it may never think of, and others may be the source of much time and expenditure?

And certainly, to most executives, expense, as an element struggling against control, is, to say the least, a matter of constant anxiety. The consideration of expense as a cost item, then, has to do with two main points:—

- 1.—Its relation to the cost of the salable article.
- 2.—The control of the expenses of the factory through proper presentation of the running facts of operation.

Much has been and will yet be written on this first point, and a number of different theories as to the proper method of expense application have been advanced.

Thus, we have theories of expense addition in proportion to units of weight or measures [the most common one], to material cost, to material and labor cost, to labor cost, to the labor hour, to the machine hour, or to various combinations of these bases. And it cannot be denied that there are cases where each theory seems most suitable.

That there are so many theories is, possibly, not a little due to the fact that there is no positively right one, but nevertheless the necessity for theory exists. But the theory must be a practical one.

Now, the statement that there is no theoretically right way to add expense to a particular unit cost must be modified somewhat, because a clear understanding of this element of cost, and its use, lies not merely at the bottom of the proper conception and use of a cost system, but, on account of the necessary changes in expense due to any change in management methods, it lies more importantly at the base of proper comprehension of the principles of factory operation, of the meaning and value of modern methods, and of the struggle for efficiency; and it is a crucial element of profit making.

It is not to be understood by this statement,

then, that there are not many items of expense which are clearly, and in measurable amounts, chargeable to the production of some particular article, since they may be due to such production; or that there are not many expenses which may be fairly chargeable to each article of manufacture in certain calculable amounts, or along certain reasonable lines, though general to the whole production. There are direct expenses and others not so direct, which, nevertheless, by varying and evident theories, can and should be directly applied. But there are many and large items of expense necessary to the whole production, however it may vary, which touch the production of any particular article in no direct manner, which do not vary with production in any close degree, and which resist all attempts to be handled as direct items of cost like labor and material. These expenses are indirect. They have distinctly to do with the whole production, without having a readily measurable relation to the unit.

It is to meet this condition that theories are devised. Each theory advanced will be valiantly upheld by those who feel they have reasoned the matter out. But it must be remembered that it is generally a failing of the formation of theories in relation to complicated conditions, that, once the basic theory is established from one main fact, all other facts are made to fit around it. We con-

stantly see this illustrated in our own theories of government, of which the tariff has long been a notable instance.

Now, in forming a theory of expense application, there are two elements to be taken into consideration with which expenses vary, even if in no absolutely measurable degree, viz.:—

1.—Time, or the labor hours of factory operation.

2.—Condition of operation, or the physical and mechanical conditions surrounding each operation.

It is very apparent that there are many expenses which vary with time, by the month, week, or hour, such as salaries, rent, indirect-labor costs, etc.

It is equally apparent that there are other expenses which vary not only with time, but also with condition of operation. No great argument, for instance, is needed to show that it is more expensive per hour's work done on a heavy machine requiring much power, costly upkeep, expensive tools, etc., than on a small one, and that the conditions of operation make the difference.

Operating, then, with these two measures of variation, it is possible to apply all expenses to units of production. But in any plant of size there is a large variety of conditions of operation and numerous items of expense having apparently somewhat different bearings. It is, therefore, necessary to form some basis of relation, some chan-

nels of flow, some theory of application and visualization of expenses, that will permit the executive to bring order, direction, and control, out of a heterogeneous group.

The old and simple way of dividing total expense by total production will no longer give sufficiently close costs. Except in very few plants manufacturing a uniform product, it no longer suits modern conditions of competition; and to work out figures for each condition of operation (which in many plants, if carried out in detail, might mean a different figure for almost every operation) presents a task almost too large for the ordinarily obtainable talent.

A midway solution, then, seems desirable, but the theory adopted must be one which leads to the most practical results in the long run, for costs, to be valuable, must render practical value. In arriving at a solution certain facts and conditions should be considered.

When the subject of costs meets the consideration of most executives, they think only of its value as leading to knowledge of the cost of the salable article. This is, of course, a very important point and if it were the only point and absolutely gauged selling price, then much detail, if it led to truer cost, need not be feared. But in actual good practice the second point, control of expense, comes to be of prime importance after the first knowledge

of cost of articles has been obtained, absorbed, and used as best it may. Therefore, any theory of expense addition that does not take this necessity into account, does not thoroughly fit the case.

For expense is a factory disease and an insidious one. It is not meant by this that expense may not profitably be large, or that profits may not, under proper conditions, be increased by increasing expense ratio. Scientific management is a definite preachment that this is so, and the average factory common sense is learning that money spent in studying operations, and in making complete arrangements for their fulfillment, is an expense that is most often much more than made up by reduction in other costs. But just as the human system is full of microbes, well balanced in health and presumably an essential part of existence, but liable under adverse circumstances to break out to the disadvantage of the container, so it is with the factory system and expense; which latter, because of varying judgments, misplaced efforts, or thoughtless management, has a constant tendency to unprofitable excess.

The executive, like the Chinese doctor, desiring to keep his plant healthy rather than to cure it when sick, should have his expenses so displayed in relation to the running situation as to be always able to control them. But in accomplishing this there must, of course, be kept in mind the ne-

cessity of arriving at an article cost which is approximately fair and true as a basis for meeting competition.

Now the cost problem, while it has to do with figures, is not a true mathematical problem in the sense that there is but one practical answer under given conditions. Cost is not a matter of figures; it is a matter of ideas, of which figures are only the suggesting elements. There can be only an approximately true and fair cost of an individual article obtained even though the cost of total production is mathematically exact, which leads us into some discussion of expense, the constant mutations of cost, and the fixing of selling prices.

Certain expenses are spoken of as fixed expenses, but they seldom remain fixed over any long period. There is a constant attempt to make production vary—generally to make it increase. The loudest cry of the factory executive is for production increase with the very intention of varying the unit expense cost—downward of course—though this cry is often checked by public demand or other conditions. The successful effort finds its result in keeping the relation of these two variants, or the percent of expense, within planned limits, or constantly downward in trend.

It must be constantly borne in mind, in forming a theory of expense application, that, in the final analysis, total expense applies strictly to total pro-

duction, and, without changing the particular conditions of operation, the expense cost per unit of production may vary very remarkably from time to time. For instance, in dull times, though there may be absolutely no change in particular conditions of operation, the expense cost per unit takes a swift upward trend. It is to prevent this that, in such periods, our manufacturers sell very cheaply abroad, if not at home.

And this leads to the fact that when discovery of net losses in certain articles is made it does not always increase total profits to discontinue their manufacture. It may frequently decrease profits to cut out losing articles unless their place in the total production is taken by profit makers. This will always be so where the loss on an article is less than the general expense burden it bears, for, whereas the rest of the manufacture only has to carry the loss in one case, if the article is dropped the remaining articles have to carry the greater burden of expense. Of course unprofitable articles should be dropped (providing the cost cannot be sufficiently reduced) if they can be replaced by other profitable ones. But the question of final profit has always to do with total production and its relation to total expense, and the practical theory of expense application and showing must deal with this question.

There is no such thing as an absolute or fixed

unit cost. Even if the material cost of a given article did not vary in different lots (and it does, because of variations in waste percent if not in base cost) and if labor cost did not vary (as it does in most factories)—nevertheless, since the total expense must be divided over total production, and since these two are constant variants, yet seldom varying together, it follows that expense cost per unit is constantly varying.

It is also a fact, that, except in the case of monopolies or special articles, and frequently even in their case, the price is fixed by competition, or a figure that will stimulate demand, and not by the cost of the article in any particular plant. As a matter of fact the selling price often fixes the cost, since many an article is definitely made to sell at a prefixed figure and the costs are arranged accordingly, and where cost has been the basis of the selling price it has generally been a cost roughly estimated and not scientifically worked out. The main value in the knowledge of unit cost in most plants is not to fix the selling price, then, but to lead to methods of cost reduction and control. So that in the interest of the attainment of an expense showing which will give the executive a grip on it, there may be safely sacrificed some of the effort to get an apparently closer cost by figuring too finely the expense cost of individual conditions of operation.

Furthermore the human element enters somewhat into this problem. The executive mind demands methods simple and easy to follow, methods that make comparisons over periods of time fairly easy, and particularly methods that show quickly the reasons of changes for the better or worse. Add to this the further fact, that for continued life it is essential in most plants that the cost system be one not subject to constant readjustments on account of slight changes in conditions of operation, on account of the undesirability of the amount of calculations that would be necessary, the failure on the part of the cost force to appreciate the changes, and the spoiling of comparisons with constant readjustment.

Let us see, then, in brief recapitulation, what are the elements to consider in forming a theory of expense application and showing. It will appear to the practical man that there exist the following conditions, which must be taken account of in any such undertaking, viz.:

That in addition to certain expenses that have a direct application to the cost of the articles of manufacture, there is a large floating expense due to the existence of the business and the policies adopted, which applies not to particular articles but to the whole production, but which does not vary as it.

That with expense added, the final cost of an

article must vary, and can be only approximately fair and true.

That while selling price, for profit, must average higher than cost, nevertheless exactly attained cost has never been the basis of fixing selling price, and that even individual unit cost has its greatest value as a basis of intelligent cost reduction and cost control.

That total plant profit is made only as a result of the total production, interlaced so to speak; and that changes in the line of articles produced, based on article cost as a guide, will not produce the mathematical result in plant profit the unit cost would seem to indicate, and that consequently expense, which causes this vagary, must be shown in some clear relation to production, or some kindred indicative element, so that changes in production will immediately reflect themselves in changes in expense ratio, increased production showing decreased ratio, and decreased production causing increased ratio.

That it is essential to make such showing of expense and its application as will offer the executive characteristic and comparative views of it, as a means of control, and that a main value of costs is to present pictures of events, in order that imperfect service may be discovered and remedies provided. Costs, of value, must be presented by a method which is a quick tattle-tale.

That comparisons are essential, and the methods used must offer them—covering the general situation, even if slurring some minor changes.

That to have continued existence the cost system must be simple, simply kept up, and readily understandable.

That expenses tend to vary according to two main elements, time and condition of operation, and these must form the basis of expense application. It must be remembered, however, that, while expenses tend to vary as these elements, in the case of very many expenses it is only a tendency and not an absolute ratio.

Working, then, from these conditions and necessities, it is not difficult to arrange the expenses according to like groups of conditions of operation, and show them in this arrangement in relation to the time of their use in given periods, preferably by weeks or months. Such groups, in most factories, will develop into classification by departments, or divisions thereof, as the conditions of operation may vary in the departments, and, of course, may be made in what detail the executive desires. But he will generally be wise not to make such divisions too fine.

Under such a plan there readily occur groupings of such like conditions of operation as general expense, department expense, department division (where conditions are radically different) and sell-

ing expense. But before these are arrived at there must be a grouping of certain miscellaneous conditions of operation, as depreciation, taxes, insurance, power, repair, etc., and a dispersion of their totals among the other groups (hereafter to be called departments) in proportion to their average or particular use in those departments.

It may be further said here that even after such divisions are made there are certain expenses which have to do, not with time or condition, but with other units. These expenses are very apparent in their application, however, and should be separately so shown.

Forms 13, 14, 15, 16, 17, 18 and 19 illustrate this method of expense analysis.

The period chosen may be either of the week or month—by the week preferably—until expense is under good control, and its application is analyzed and understood. If kept by the month, however, this method resolves itself into a very simple affair.

It may be well to say here that under such a plan of expense analysis the use of the "Voucher Register," Form 20, offers a very simple arrival. This book, as will be seen, is an entry book for all money spent whatsoever. Under the column "Expense," go all the items so chargeable, which may find their analysis under the column "Explanation," in whatever detail may be desirable to make up the analysis at the end of the week or month, the to-

tals of which must agree with the totals of the "Voucher Register" and consequently with the one ledger account "Expense" which this method permits. By such a method it is no great task to make up an expense analysis in a short time, each month, even if there be fifty or more departments.

It may not be needless to give, here, some slight description of these forms and their application to the use of the industrial executive.

Form 13 shows a division of depreciation, taxes, and insurance among the different departments. It is not the purpose here to go into lengthy discussions of certain details, because almost all the details of expense will bear much consideration. It may be said, briefly, that a conservative depreciation would be 10 per cent on machinery and equipment, and $2\frac{1}{2}$ to 5 per cent on buildings, although, for those who desire or feel the necessity for detail, each unit of investment may be depreciated separately and according to experience or estimate. Depreciation, taxes, and insurance are apportioned to the departments according to investment therein.

Form 14 shows the details and totals of power cost, and its division between the departments in proportion to average use.

Form 15 shows the details of repair cost and its apportionment to the different departments according to the actual expenditures in them.

Form 16 shows the general expenses.

FORM 16—EXPENSE ANALYSIS—GEN

RATE FOR PREVIOUS 3 YEARS 12 $\frac{1}{2}$, 13 $\frac{1}{2}$, 14 cts.	April, 1912—4 Weeks	
	MONTH	PERIOD TO DATE
Office Salaries.....	2,500.00	10,000.00
“ Stationery	93.08	93.08
“ Supplies.....	0.00	61.15
Telephone.....	30.00	100.00
Incoming Express.....	43.18	124.90
“ Freight.....	340.00	582.00
Trucking.....	118.30	333.90
Watching.....	81.00	325.80
Miscellaneous General Labor	135.09	510.40
Miscellaneous General Supplies	283.42	711.15
General Repair Labor.....	250.00	504.15
“ “ Materials...	262.18	376.70
Pensions, Insurance, etc...	902.80	1,152.40
Donations.....	75.00	75.00
Legal Expense.....	200.00	800.00
Total General Expense....	5,314.05	15,750.80
Total Direct Hours.....	32,640.00	106,013.00
Cost per Hour.....	16 $\frac{1}{4}$ cts.	15 cts.

Showing, in any desired detail, the expenses which are general to the whole plant. The monthly and period figures, and in relation of expense to direct-labor hours desired to direct labor.

2-4 Weeks
PERIOD TO DATE

980.00

610.20

615.56

563.07

62.48

647.18

212.65

124.10

204.24

4,019.48

3,187.31

783.30

7,990.09

29,121

28 $\frac{1}{2}$ cts.

7,260.48

114

Form 17 shows department expenses in detail by months and periods, in comparison with previous records, and in relation to direct-labor hours or direct-labor cost. The expense is divided into controllable expense (which occurs under direct supervision of foreman) and other expenses properly chargeable to the department.

Form 17 shows the department expenses with their additions from other departments. There will, of course, be as many of these showings, in the expense analysis, as there are departments or divisions made to cover the productive portion of the plant. The expense of the department is totaled first to a "Controllable Expense," this being the amount occurable in the department, and so under the control and supervision of the foreman.

Now, in all these forms which, complete, give an analysis of expenses, there is to be noted that, month after month, the expenses, in all detail desirable, are shown comparatively, and likewise the additions of the same to date from a given start, generally the first of the year or inventory time, these latter additions being known as period-expenses. Any increase or decrease can be immediately noted.

In addition, the relation of the expenses is shown to the running productive situation. This is expressed, preferably, as a cost per productive or direct-labor hour, such hours of each department being kept for each month and an expense cost per hour worked out. But in departments where the work is similar and the wages of employees are practically alike, it is as effective to show the relation of expenses to the direct or productive labor. Both methods are illustrated. Thus, with such a constant and easily readable showing of expense

and its relations to the running production in all the different departments, the executive has an opportunity to study expense, to experiment with it, and to control it.

But to make it as easy as possible, Form 19 is added.

This form is a synopsis of the whole situation, showing first the index figure for the plant, and then the index figures for the departments with plant index figures for previous years. Through this the executive can put his finger on the weak spot, monthly, without poring over the whole situation, and in a very short time can compare the plant situations with previous periods. In this particular form the expense is shown in relation to direct labor, but can easily be shown in relation to productive or direct-labor hour.

As will be seen, expense cost as applied to an article varies as labor cost or labor time. This is an important fact, for if the time of labor operations can be shortened, the expense cost as well is reduced, and with proper means of assuring himself of the facts, the executive can afford to increase such expense as is caused by the study, preparation for, and assistance to labor, with the idea of reducing operation time, knowing that he can readily discover quickly the total cost-labor and expense—and compare it with previous conditions.

AND ADVERTISING

May, 1912—4 Weeks		
MONTH	PERIOD TO DATE	
1,500.00	7,500.00	
291.14	1,406.30	
43.00	438.20	
6.20	48.40	
15.13	168.32	
432.00	1,458.18	
75.62	346.53	
0.00	138.12	
0.00	675.26	
24.93	241.83	
1,420.00	7,100.00	
900.00	2,959.00	
4,708.02	22,480.14	
59,654.80	267,621.28	
7.9	8.4	
ng selling expense may be depart- me lines and Advertising may rtised.		

Form 18 gives selling expense, which is shown in relation to sales, or indicating the number of cents it takes to sell a dollar's worth of goods. Here, it will be observed, are added cash discounts taken by customers, and bad debts. The selling may be departmentized where there exist definite divisions, and the advertising may be shown in relation to particular articles, or classes.

As will be seen in Form 4 (see page 57), expense is added on unit production cost, when labor time or cost is known, first as a charge per total hours for general expense, followed by a charge per productive or direct-labor hour in each department, or as a per cent on direct labor, as the choice may be. Selling expense being added, the complete tale of expense, in its relation to the salable article, is told.

There may be disputes as to whether sundry items should be put into expense and the practice is varied in this matter. A good practical basis of operation, however, in these matters, is that costs should be made as high as they legitimately can, and that the difference between cost and selling price, if a profit, should be a final one from which are to be deducted not even contingencies. Human nature needs the spur of necessity to make improvements and a high cost is a valid incentive to action in that direction. Depreciation, and a high one, on tools and apparatus liable to change,

losses on material when they cannot be charged to an article of manufacture, samples, cash discounts, bad debts, and, under some circumstances, interest, and in fact every charge which does not belong to the material or labor costs, should be put into costs. It is healthy cost where the dollar of profit can be placed in the bank.

The method outlined is not a new theory. It has been in very successful practice for at least eight or ten years, and is now in operation in some one hundred or more plants.

The philosophy of cost has nowhere a more important bearing than in dealing with the expense analysis.

Practical accuracy, it is very plain, is the only term that could be applied to expense application under any form of analysis, but under this form it is easily apparent that the totals can readily be made accurate to the penny.

The indirectness of its application, the constant pressure for its increase, inability to control it except by extreme watchfulness, make imagination to visualize expense in its effect and final result and value a very essential element for executive use. With the use, however, of the forms of expense analysis illustrated, the department, from the expense point of view, looms up clearly with its condition shown from month to month and period to period, and its relation to the productive situa-

tion. And it takes a hard-headed imagination to visualize the future with sufficient confidence to increase expense in an attempt to reduce wastes and labor cost of operation. Yet to double expense cost per hour, if labor operation cost can be cut in two, is to reduce cost, not to mention possibilities of waste saving.

Here, then, steps in the practical instinct which, with the shrewd use of imagination, traces the probable effect of expense action, and renders the profitable decision, whether it be to spend or restrict.

Standards are somewhat difficult to form in expenses, and are necessarily varying as policies and conditions change. They can and should be made, however, and be given to those who may have some control of expense.

Comparisons are, of course, of vital necessity.

Without arrangement no executive could follow the intricate course of a mass of expenses and rightly interpret their effects, but with such an arrangement as this expense analysis, starting with Form 19, the executive can pass quickly over the whole situation, concentrating his attention on the departments and expenses needing it most. Through such arrangement the alert executive can keep very close touch on the situation.

In the matter of periodicity expense analysis may be made weekly at the close of the payroll,

and from the point of close contact with it and regularity, there are advantages in this period. It will ordinarily be shown by the month as simpler to make up.

Co-operation of the executive organization finds no better field for action than in studying the expense analysis and assisting in the effectiveness of expense. They are, indeed, a part of it, and much of it depends on their force, executive ability, and arrangement of affairs. They should then be let into its secrets. They should be shown its effects and results.

It may be said finally that in competitive businesses it is more important that the theories of expense application should be alike, than that they should be exact, except in totals, and under any theory it is essential that expense include every proper item. It is a mistake that many executives make to class certain items, liable to quick disappearance or obsolescence, as assets. While it may make book profit appear larger, it makes actual profits no larger. These two points were the bases of the standard cost system adopted by the National Association of Machine Tool Builders, which the writer devised.

Expense is distinctly the tool of the executive. Material use comes naturally from the design. Labor is essential in all cases to its shaping. But expense is the instrument with which the executive

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Totals.....

EXPLANATION

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for detail by depart-
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82 Mch.

NOTE. This is simply a form of day book where all expenditures may be recorded and divided into the four main classes—Material, Labor, Expense and Permanent Assets—with columns to render such explanation as may be necessary for further detailed analysis.

shapes his factory course, his weapon in fighting the battle of profit. There are rules for its use, but they are not readily discernible except by experiment, nor readily workable except with the use of thought, patience and persistence. Closeness in expenditure, low expense ratio, may, according to circumstances, mean eventual dry-rot or safe profit. Liberality in expense may, according to the conditions of it, mean eventual ruin, or increase of profits. There is always a certain amount of expense that is absolutely necessary to the existence of the factory organization, and it is true that any other item of expense is wisely added when it fulfils a definite purpose that leads to an economy eventually greater than the expenditure; and a clear knowledge of expense and its relation to production is essential to such calculation.

STATISTICS AS AN AID

CHAPTER VII

STATISTICS AS AN AID

IN the study of the progress of the manufacturing situation through figures, it is not sufficient that the executive give consideration only to the bare costs of articles, or to the showings of material, labor, and expense conditions alone; for these figures, valuable as they are, are merely reflections of conditions into which enter yet other elements very vital to ultimate welfare. Without a proper knowledge of these elements and their variations, the progress and possibilities of the situation are not well brought out, and policies of operation looking towards the future (for the wise executive thinks always for the future, realizing how swiftly it merges into the present) are not well founded on the facts, or frequently are not even suggested.

A cost system must then be buttressed with statistics. These statistics should be preferably a part of the cost-department's work, since they interlace with and support the cost system, and, in fact, have to do with facts frequently already a part of the cost situation, but in connections and guises different from those which, in the form of separate

statistics (for costs are merely statistics remodeled), are necessary to show their value and relation to the moving situation. Many plants, of course, have certain statistics, even when they have not costs, but such statistics can not render the most complete values.

There need be no lengthy arguments advanced as to the value of statistics. They are simply essential as a presentation of running facts illuminating conditions for the enlightenment of the executive, so that his judgment and energy may be guided by certain knowledge. Too often, without them, impressions based on isolated occurrences which are not representative tend to lead the executive astray. With them the course may not always be clear, but it is much easier to steer.

Nor are there any theories of presentation, except those dictated by common-sense, as to showing the facts so that they will make the situation quickly clear. Of course the principles of the cost philosophy apply here. Accuracy, standards, comparisons, arrangement, periodicity, as previously explained, are plainly essentials to statistics of value. Imagination, practical instinct and co-operation of the executive organization will be found to be vital necessities in the attainment of results of maximum value through statistics. The discussion on statistics becomes, then, almost a simple recital of facts to be illustrated.

The first important series of progressive facts marshalled under the head of statistics should have to do with the selling situation. From the statistical point of view there are three conditions to be considered in their relations to each other—the volume of sales of salable articles, the market, and the means of connecting them.

It is not the scope of this chapter to deal with particular methods of selling or of getting results in this vitally important department of manufacturing plants, except to point out that from statistics and their study naturally will flow suggestions of desirable or necessary policies, through indications of tendencies shown toward either good or poor results; and that, likewise, on the opposite hand, statistics will show what are the results of certain practical plans and methods.

The statistics of articles from the selling point of view have to do, in very many plants, not merely with the details of shipments, but frequently more importantly with the details of orders as they arrive. In many cases shipments are seasonable but orders must be taken well in advance, and the volume and significance must be known continuously so that proper and economical manufacturing arrangements may be made. In other cases these facts must gauge the question of volume of stock to be made up and carried. But, more significantly from the strictly selling point of view, it is im-

portant to know the ratio of low-profit and high-profit goods sold (for every factory has the two classes), the ratios of different grades, sizes, etc., of the same article as sold, and, especially and particularly, the progress of sales of the different lines over definite, active periods as compared with similar previous periods, for these facts gauge the market conditions and the value of means of connecting with the market, which knowledge is very essential.

Generally speaking, then, there should be detailed statistics showing volume of orders on hand of different articles, which can readily be kept up daily or weekly by adding orders and subtracting shipments; which record will permit economic anticipation and arrangement of the manufacturing situation. Likewise there should be detailed period records of sales of different articles, comparable always with the records of previous similar periods, in order to show their progress backward or forward. Forms 21 and 22 illustrate such methods. It must be understood, however, that in each business its own peculiarities must be met and the forms illustrated can only furnish general ideas. From such a form as Form 21 it is plain that a constant knowledge of the necessities of production is to be had, and this form, of course, can be varied to give this knowledge over any period, or for present and future orders. Given the knowledge of



PERIOD

MONTH

PERIOD

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productive ability in the plant, this form, especially adaptable in the shown conditions to staple articles, becomes a definite forecast.

Form 22, if the figures are compared with the figures of similar previous periods, and if some mark is attached to show percentages of profit on the different articles, becomes very essential in the struggle to keep the most profitable articles to the front.

In the matter of markets, proper statistics will show where the sales are made according to territories, and, in a varied line, even according to customers. These facts, together with some study of population and conditions of sections, show readily the proper points of attack and contact and bring about the increasing of lines, both in variety and quality, with customers already made. Forms 23 and 24 illustrate possible methods. Form 23 gives merely the viewpoint of locality of sales, and may be put into as much detail of territory and articles as desired. Form 24 shows possibility of analyzing customers' sales and comparing them with previous periods. It will be understood, of course, that none of these forms are offered for copy, but merely to suggest possibilities in different directions, in the simplest way.

The third point of value, then, in sales statistics arises in a study of the means of connection between the article and the market. This, in very

many cases, will mean a study of the results from salesmen. An executive, naturally, for judgment as to value, desires to know the relation of the sales by a salesman to his salary and expenses, but with a proper cost system he should and can preferably know the relation of the profits on the sale to the cost of obtaining them, because, frequently, the salesman with the low percentage of cost to the sales may have a high percentage of cost to the profit on the sales, due to selling principally low-profit goods, or of constant concessions in price. The plant with a good selling force has made a long step toward prosperity, and a good sales force is only exceptionally built without a basis of the facts. Form 25 illustrates a method of observing salesmen's results.

The value of advertising, while it may not be always definitely measured, should be shown by statistics giving the relation of advertising cost to the sale of the articles advertised and its effect in districts, where possible.

Such statistics of selling, to which may be added others suggested by circumstances or the peculiarities of business, will keep the whole situation plain as to its tendency, will keep the force keyed up to constantly bettering the results, and will lead to policies and plans for improved results.

The next important use for statistics has to do with production. It is hardly needful to repeat

FORM 25—SALESMEN'S SHOW

ARTICLE		MONTH April	
		SALES	PROFIT
A	MONTH	1,012.12	91.80
	PERIOD	4,629.20	416.61
B	MONTH	300.16	60.03
	PERIOD	1,213.87	242.75
C	MONTH	2,500.10	375.01
	PERIOD	9,000.26	1,350.06
D	MONTH	187.90	46.98
	PERIOD	512.69	128.16
E	MONTH	5.12	2.04
	PERIOD	102.18	40.84
F	MONTH	8,612.91	1,033.54
	PERIOD	32,650.52	3,918.00
TOTALS, MONTH.....		12,618.31	1,609.40
" PERIOD.....		48,108.72	6,096.42
SAL. AND EXP., MONTH			502.28
" " PERIOD.			2,082.16
PER CENT. TO PROFITS.			
MONTH			31
" "			34

NG

MONTH May		
SALES	PROFIT	
2,062.19	185.59	
6,691.39	602.20	
417.26	83.45	
1,631.13	326.20	
2,200.16	330.02	
11,200.42	1,680.08	
120.19	30.05	
632.88	158.21	
6.20	2.48	
108.38	43.32	
9,200.12	1,104.00	
41,850.64	5,022.00	
14,006.12	1,735.59	
62,114.84	7,832.01	
	532.19	
	2,624.35	
	30.7	
	33.5	

NOTE. This form affords a simple method of making clear a salesman's value. The vital elements are a showing of his sales on different lines, the profits he obtains, and his salary and expenses in relation to the profits, or to the sales where profits are not worked out.

that because of possibilities of cost reduction in labor and expense, the struggle in every factory is to get the maximum production in given units of time—from men, machines, departments, and the factory. This struggle, to be maintained, requires the constant trail of comparative statistics.

There is, of course, an art, a trick of swift and clear illustration in statistical showing. It is neither possible nor desirable to keep great detail of production at every point, but total of articles in given periods (sometimes in units of weight or quantity, and sometimes in value) can be kept constantly with the idea of analysis downward, when desired. And most particularly is it valuable if the “squeeze point” or point of most difficult production be found, and the record of progress there be kept. With such statistics of production it is frequently necessary to show, also, certain facts of essential connection, as speeds of machines, temperatures, weather conditions, etc., to explain them and their variations.

Of course, a very vital point, not to be passed by, is the relation of production to the running sales, in connection with the stock on hand, in order that proper plans for the future may be considered, and in order that neither may the sales run far ahead of the production, causing complaints of delay and cancellation, or the production much exceed sales, causing an expensive and dangerous piling up of

stock. Statistics of manufactured goods unsold, on hand, almost always amply pay for their cost of up-keep. There are in mind several important concerns, which, on account of the former difficulty (due wholly, not to a lack of *statistics*, but of *illuminating statistics*), lost much trade; and at least two concerns, which, because of the latter difficulty, found themselves compelled to assign. In the case of these concerns the proper statistics would have been worth thousands of dollars. Form 21, already referred to, illustrates a simple method for plants of some kinds.

The statistics of sales and production, and, of course, of consequent completion of sales by shipment, together with the cost method indicated in previous articles, including the statistics of waste, labor operations, and expenses there shown, cover fairly completely the main situations, in the light of fact illustration. There are, however, as every inquisitive and investigating executive will discover, innumerable other desirable points of knowledge, which seem to demand illumination through statistics. Almost every detail of manufacture seems to be susceptible of further enlightenment. But the wise executive, before covering too minutely the manufacturing situation with statistics, will consider the possible values to be obtained, the time of what people can be properly put into consideration of such facts, and the cost of obtaining

them. Where a probable real value is to be obtained, it would not be wise, of course, to pass over too quickly any investigations. But it must be remembered that, however beautiful the theory and thought that every situation is made clear by compilations of facts, nevertheless it is often fully as great an economic folly to be overburdened with facts to be studied and assimilated, as it is to depend on judgment and watchfulness alone unillumined by a systematic trail of fact-pictures.

It is often valuable to plot the statistics into curves, particularly as showing tendencies or relations of several factors over continued periods. In general, however, such curves can show only tendencies, and they are mainly valuable to the executive who may desire to use them to make plain the situation to others above or below him. Generally he, himself, will follow the figures.

A wise method to pursue always in designing statistics is to start with general compilations covering the larger situation, and only go further into details as the situation seems to demand. Thus the executive can generally study each situation from the large point of view, and his judgment in digging deeper will be guided purely by the apparent necessities of each situation rather than by the mere desire to compile statistics.

There is illustrated in Form 26 a combination set of statistics and costs called the "Weekly Cost

and History." As will be seen, this form illustrates the whole progress of a department in labor, expense, production, and waste for week after week comparatively. It is not advised for all plants, nor as the best method to be operated continuously for any one plant, but as a method of getting a department into good shape and under control it has been found a simple and valuable method. The facts shown, of course, may be varied to suit the situation and the desires of the executive.

No executive can afford to spend the larger part of his time studying statistics, but it is only the common-sense of his duty to review the different sections of his factory situation periodically, with the idea of assuring himself of their progress according to plan, or of planning future steps of progress; and that executive who believes in his own ability or that of his subordinates to do these things purely on their impressions or judgment is taking a long chance on his plant's success. Since so much of success depends on human effort, it is never amiss, but always well, to judge of future possibilities by past records, and statistics lend this opportunity.

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**COST SYSTEM—THE BASIC IMPROVE-
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CHAPTER VIII

COST SYSTEM—THE BASIC IMPROVEMENT

THAT the future of the cost system is to be one of universal and valuable employment, and of higher and more practical development, is assured by many growing necessities, not only intimate to the individual plant and its proper management, but requisite as well to the common welfare in the advancement of industrial development and its economic aid and control by law, which latter it seems business is not to escape.

If, for example, our tariff is to be adjusted scientifically on a basis of actual costs, as attempted by the late Tariff Commission, it is, in fairness to all, essential that there be in existence not merely general figures giving unit cost on bulk production, but complete costs in various like plants, uniform in method and discriminating as to grades and qualities. Not for long can certain general expenditures, averaged over total production, serve a final and just purpose.

Then there is a continuous outcry against the high cost of living, and there grows a public suspicion that this exists not merely because of a depreciation of gold and advancing wages, but be-

cause of undue profits on the part of capital, and such ideas as the Government control of prices are seriously advanced. Yet prices could never be justly controlled, nor indeed an investigation render a properly reasonable basis for action, until a fair number of like plants have discriminating and uniform cost systems. And certainly no such condition exists at the present time in any large proportion of the different classes of manufacture, though concerted action by associations of manufacturers is tending to bring this about.

If, then, the Government is to regulate matters that have to do with prices and profits, it would seem that it must likewise assume the responsibility of forming a proper basis of knowledge for such action. This, of course, opens up a wide problem with which the Government is not entirely unfamiliar since its work with railroad accounting, but which it has not been able to solve successfully as yet in its own departmental affairs, according to the President's message to Congress on Economy and Efficiency in Government Service.

It has been suggested in another connection that a Government bureau might render valuable aid to our manufacturing industries by studying their problems in some detail, as it has those of the agricultural industry, in which case there might be a reversal of the opinion held today by many manufacturers—that the Government is too busy telling

them what they can not do to give any valuable information as to what they may, with profit, do.

To one who has studied costs and their value, and seen the practice active and effective in control when properly operated (though widely variant in principles and methods of application) and who has reflected on the tremendous and growing ramifications and difficulties of this great industrial era, the value (and indeed the necessity) of control, and the necessity of basing remedial action on the real facts of the situation, it would seem that a Government Bureau of Industrial Research might render substantial values. Its problems would be large, and diplomatic as well as practical, since manufacturers have ways of their own to which they are much attached, and are slow to absorb the methods of others no matter how alluring in the recital. But its first work must essentially be the study, devising, and publication of practical and discriminating cost systems for various classes of manufacture, since all other experiments must meet the test of comparative costs. And the publicity of any investigations it might be authorized to make, when these were based on a pre-established method, would go far toward showing remedies for situations now very puzzling. In any case, it is entirely logical that much economic business law of future construction must have a basis of proper costs. The wise executive will prepare himself for

this, and it is not an entirely disquieting thought for him, that if such laws may seem to hamper him, they will likewise hamper his competitors and render him equal justice with them.

But apart from any such ideas, the value to the individual plant of the right and practical cost system is an ample compensation for its careful and detailed employment.

It might appear valuable here to give some idea of what is a right and practical cost system (for its development is somewhat modern, and its importance even more so) on account of its value in the introduction of modern methods of management.

Accounting, since the introduction of the double-entry book-keeping system, has reached a high state of development in rendering exact account of receipts and expenditures of a business. In its most universal practice, it has to do with the payments of bills for whatever purpose, with the accumulation into certain general or desired classifications of amounts of expenditure covering the total over given periods, and with the billing and record of all items of sale, and their classifications. It has to do with the changing records of assets and liabilities, and, through periodical actual inventories, with the showing of gross and net profits. It has to do with a proper showing of the debts of the business and the amounts owing to it. It has

to do with credits, finances, bank relations, notes, drafts, etc. In fact, it has developed into a complete showing of the business in its relation to other businesses in detail, and only a general showing of the internal operations under certain heads with a periodical net result.

In the profession of accountancy there has been developed an expert body of accountants and bookkeepers, to whom is entrusted much in confidence, and whose work develops or demands a certain temperament.

The cost system takes hold where accounting leaves off. It has in common with accounting only two things—the use of the same set of figures of expenditure, and the value of the accounting as a means of proof. It deals with internal affairs only, in contradistinction to accounting's dealing with external affairs. Accounting and costs are complements in a showing of the operation of a business.

In its dealings with the internal affairs of the business, the cost system, to be right and practical, must not merely present fairly true and proved costs of all articles produced (which has long been considered the chief if not indeed the only use of a cost system), but it must present constantly and comparatively pictures of the progress of certain sections of the business, showings of the divisions and departments, wastes, variations from the stand-

ard of costs of operations of labor and expense. It must, beginning at general or specific totals, be prepared to run back over the ground and show fact and reason, in slightest detail, of differences observed by comparison, or of operations desired for whatsoever reason. It must follow production and illustrate its variations and the results to the welfare of the business. To it material is but base cost and waste; labor is but an instrument of production whose reward is constantly to be gauged by its effect on the unit cost of production; expense is an element whose value is to be determined by its effect on, and increasing or decreasing relation to, the article cost. The cost system, in fact, should become the moving-picture film of the business in its constant internal mutations. When it has become so, then it will be found offering, urging, and indeed forcing, methods of improvement and control.

In the modern struggle for improvement, scientific study of management methods, and lower cost (or rather, as the race now runs, of the prevention of too great cost-increase), the practical cost system must be the foundation stone. In the mind of every sensibly ambitious and up-to-date executive, looking for methods which will render to his employees and his stockholders as well as to the public the best service, the cost system must strike the keynote, for it will prove not only a constant

prodder as to the necessity of change and improvement, but it will point the weak spots, and it will differentiate the values of different methods.

The executive desiring to keep up to date, to install in his plant better methods of organization, of wage payment, of work routing, of production increase, of waste saving, of sales increase—in fact, of general or specific improvement, or to maintain what he has, will do best to make sure first that he has a right and practical cost system, for cost system is the basic improvement. Figures form the body of costs, but the right and practical cost system has a soul that keeps demanding right shop methods.

This division between the accounting and the cost system, the one showing the external and the other the internal affairs of the manufacturing plant, has never been well understood or acknowledged, although practiced in many plants, because the cost system has not been developed as ably and exactly as has accounting; because both use figures as an instrument, it has not been appreciated that a practical cost system is more a presentation of ideas than accounting. And this failure has brought about a definite weakness in the cost system. The good accounting system has an extreme similarity in all businesses, but while the principles are the same, the proper practice of the cost system varies materially in different plants, according to condi-

tions, nature of organization, circumstances, and kind of manufacture.

In general, then, the cost system, for best value, demands, both in introduction and in practice, a somewhat different experience and different temperament than does accounting.

It needs likewise what it has not obtained in very many plants—an understanding by the executive of its principles, its practice and its possibilities. The practical man is too liable to look upon figures of cost with contempt when they do not show the results his judgment anticipated. Yet one of the first valuable effects of a cost system is to show the fallibility of the judgment of the practical man when he deals with costs. It would be a happier future for many plants if the superintendents were promoted to the cost department, or if their young men in training for future executive duties should take a course in this department.

But one thing ought to be clearly understood, viz., that despite the constant talk of systems of all kinds, and their value, no business is made a success by them alone. Business success is made by policies, energy, enthusiasm, work, and sagacity. In a struggle of brains *versus* system, brains will usually win. System, and especially cost system, is merely a tool with which brains enhances its effectiveness by using it as a basis of knowledge to start with and as a check and framework to hold

the whole together like the wax in a honey-comb, and it assumes importance only as intelligence, persistence, and energy wield it.

It has frequently happened that the tool has been built too large to wield, but it has also too often happened that even when properly built it has been put into the hands of an operative too weak to handle it. When, and where, the complete value of a cost system is understood, it will be found remunerative by the executive to put it in charge of a man who is well paid not only because he is expert with figures, but because he is practical, patient, a thorough investigator, analytical of mind, logical in his conclusions, and resourceful, just as the accountant is well paid when he possesses, in addition to his expertness, a watchfulness of external financial relations, and a trustworthiness. And such a cost man should have time not only to make the figures but to investigate and interpret them.

Now as to the weakness that has been developed in cost-system practice through the failure of the executive to busy himself with its understanding, and the failure to distinguish between accounting and cost system and the necessities of their varying practice, this has taken place at two points—its introduction and its practice.

In the introduction of cost system, accountants have taken the lead because of their expertness with figures, and not unnaturally; but they have

too often failed either to have, or to get, the practical man's viewpoint in their structure, or, with an understanding of human nature, to create internally that enthusiasm and appreciation which alone can bring best results. Accountants have too frequently mistaken the form for the substance, for the strong tendency of accounting is towards form, and the strong necessity of a cost system is substance. The result has been in many plants a cumbersome and inefficient, even if not entirely ineffective, system. This is not to belittle accountants, who have an ample and sufficient usefulness, and many of whom have also the requisite abilities for any work they may undertake. But this practice has led many impractical men into the industrial-engineering field.

Again, in the practice, the weakness developed has come about through the intrusting of the cost system into the hands of men with purely clerical ability, because of the failure of the executive to appreciate the values to be obtained from the employment of the more highly trained practical man.

Time must of course correct these weaknesses, but it can do so only through the education of the executive as to the values hidden in the right and practical cost system, and this must come through the training of the younger generation.

It may not be considered amiss to repeat here that the best way to build a cost system is from

the totals down to the details, and not from the details up to the totals. The former is the logical way for many reasons. It is easier to obtain the totals and to prove them correct, thus obtaining a sure foundation to build upon. It is a difficult and discouraging task to gather a great mass of details and prove them with totals, and where this has been undertaken it has usually resulted in the rendering of presumed, but unproven, costs of articles without those values of cost control which are essential to a good system. But if the system starts with the totals of the three general elements—material, labor, and expense—as proven with the accounting; divides these into sub-totals, and these into still other subdivisions, as circumstances and conditions of organization, of departments and divisions thereof, and of articles of manufacture demand, then the proceeding follows from proof to proof, and from significant total to detailed analysis as is desired.

Such a scheme is of course naturally dependent upon the aim in view for the cast of its final analysis, for it should plainly be understood that with the mass of petty operations and changing situations which make up the total of production, a definite schedule of desired enlightenment must be made if the cost system is not to produce a mass of useless figures, or fall short of a full illustration of the whole situation. This is to say that the cost

system should be planned in advance as to what it is to accomplish.

Two elements are very essential in the building of a cost system—persistence and time. It takes, in a plant of any size, from one to two years' time to build a good system, because so much human nature is involved, from the executive down, and persistence follows as an essential to these conditions. The firm support of the executive against all difficulties, physical and human, must be given.

A cost system is an encourager of high wages. There is, in many plants, an opposition to high wages due to the belief that increasing wages necessarily mean increasing cost. Of course, under certain conditions, as in a horizontal wage increase, this is so, but a study of the detailed wage situation through the cost system will almost invariably show, under right manufacturing conditions, that the earners of the highest wages are the producers of the lowest unit-cost.

The proper cost system is a selector and former of good organization, for it shows plainly the well operated and improving departments and those badly run, and forces necessary changes, or creates through its normal effect a more determined, resourceful, and careful management; for cost is the basic improvement. But it does not stop at the executive organization. Its proper use gauges the value and efficiency of every operative, every ma-

chine, every method, and every operation. With the proper standards it thus becomes a valuable instrument, but it must be realized by the executive that in its ordinary use it is not a barometer but only a thermometer. It merely states the past occurrence and renders only the values which enthusiasm, resource, and intelligence draw from it. But with the proper use it can become not merely historical but prophetic, because once the cost system has established a clear backward trail of events, and reasonable methods of control of shop operations have been introduced, it is no difficult feat to prognosticate future results with it, either as to the article costs or as to sectional or total net results. And when this can be done the cost system is established.

A well operated cost system is a species of insurance. It insures against continuance of unprofitable policies, the taking of unprofitable orders. It is also a good credit maker. There is in mind the case of a manufacturer who during the recent panic, upon being refused a loan, took his cost system to the bank, and had no difficulty in persuading the banker that his business was conducted properly on a basis of knowledge.

In conclusion then, the logic, the common sense, and the business sense of the manufacturing situation are inevitable. Every manufacturing plant demands a cost system presenting regularly the

facts of the situation. But just as a painting of the veriest amateur may be labeled "A Landscape," where some of the bare facts of nature stand cold and warped, while a Corot similarly named permits the imagination to dwell and appreciate the true facts and beauties, so the term "Cost System" is used to cover that situation where disconnected and unproved figures are used to determine policies, where masses of figures unintelligent in their communications are collected, and every gradation up to that situation where the cost system with the minimum work illustrates clearly the changing conditions as a solid basis for action.

It is plain, then, that the executive needs a standard by which to gauge his cost system. But the standard is evident. It must present to him, in a proven way, the fair, complete costs of his units of production; it must tell the story of the use and waste of his materials; it must illustrate in operation and in groups the productivity of his labor; it must picture the values and returns, in units and by divisions, of his expenses and their relations to labor operations and sales; it must marshal facts illustrative of the movements and relations of productions and sales, and of the changing situation as may be desired, or of the comparative values of methods; and it must do these things with the minimum of time and exertion on the part of the executive; for too much cost system, too many fig-

ures, defeat the real purpose of cost, clogging action.

When it does these things with a fair readiness so that the business intelligence of the executive can grasp the truth (for let it not be forgotten that with all its possibilities the cost system is merely an inanimate record)—when it does these things, then, the executive has introduced into his business a moving-picture show of his manufacturing (more comprehensive than photography, which has its uses in this connection), comprehending a vision of the whole as well as every part, and which can be run over again and again as he desires, and in comparisons.

When he has accomplished this introduction, the executive will have that which, with the aid of the philosophy of costs, will be a constant refining influence in his plant, will check, spur, and encourage his organization, will urge constantly, by showing value, improved methods. And his business will then be in possession of a right cost system—the basic improvement.

THE END

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